REVISED DRAFT ENGINEERING EVALUATION/COST ANALYSIS

Avery Landing Site
Avery, Idaho
TDD: 08-05-0006

Prepared for:

U.S. Environmental Protection Agency, Region 10
805 SW Broadway, Suite 500
Portland, Oregon 97205

Prepared by:

Ecology and Environment, Inc.
720 Third Avenue, Suite 1700
Seattle, Washington 98104

November 2010

This page intentionally left blank.

Table of Contents

Table of Contents (cont.)

Section **Page**

Table of Contents (cont.)

Section **Page**

Table of Contents (cont.)

Section **Page**

This page intentionally left blank.

List of Tables

This page intentionally left blank.

List of Figures

This page intentionally left blank.

List of Abbreviations

Abbreviation	Definition
%	percent
°F	degrees Fahrenheit
AOC	Administrative Order on Consent
ARAR	applicable or relevant and appropriate requirements
ART	ART Engineering, LLC
AST	above-ground storage tank
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMC	CMC Real Estate Company
COCs	contaminants of concern
CSM	conceptual site model
DRO	diesel-range organics
E & E	Ecology and Environment, Inc.
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
FHA	Federal Highway Administration
FoE	frequency of exceedance
ft/day	feet per day
Golder	Golder Associates, Inc.
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IDTL	Initial Default Target Levels
LNAPL	light non-aqueous phase liquid
LTTD	low-temperature thermal desorption
µg/L	micrograms per liter
MCLs	Maximum Contaminant Levels
mg/kg	milligrams per kilogram

Commented [SH1]: Should it be FHA or WFL?

Milwaukee Railroad	Chicago, Milwaukee, St. Paul and Pacific Railroad
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emission Standard for Hazardous Air Pollutants
OPA	Oil Pollution Act
OSHA	Occupational Safety and Health Administration
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
Potlatch	Potlatch Corporation
PVC	polyvinyl chloride
RAOs	removal action objectives
RSL	Regional Screening Levels
START	Superfund Technical Assessment and Response Team
SVOCs	semivolatile organic compounds
TAT	Technical Assistance Team
TDD	Technical Direction Document
UECA	Uniform Environmental Covenants Act
URS	URS Consultants, Inc.
USGS	United States Geological Survey
VOC	volatile organic compounds

Executive Summary

The Avery Landing Site is a former railroad roundhouse an maintenance facility for the Chicago, Milwaukee, St. Paul, and Pacific Railroad (Milwaukee Railroad) located in Avery, Idaho. Railroad operations at the site ceased in the 1970s, and most of the railroad facilities and structures were subsequently demolished. Portions of the former railroad facility site are currently owned by Potlatch, Larry Bentcik, the Federal Highway Administration (FHA), and Shoshone County. Potlatch currently owns the largest portion of the site, and they have used their property for log storage and for temporary housing of employees.

Commented [SH2]: Please review.

Soil, groundwater, surface water, and sediment at the Avery Landing site contain petroleum hydrocarbons and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances that are associated with the site's historical use as a railroad roundhouse and maintenance facility for the Chicago, Milwaukee, St. Paul, and Pacific Railroad (Milwaukee Railroad). Petroleum hydrocarbons (diesel and heavy oil) and other hazardous substances are present in subsurface soil and groundwater and are seeping into the St. Joe River, which is adjacent to the site. Petroleum releases to surfaces water of the United States are a violation of the Oil Pollution Act. Petroleum as light non-aqueous phase liquid (LNAPL) is present on groundwater and surface water at greater than 0.01 feet, in violation of State of Idaho regulations.

Investigations and cleanup actions have been performed at the site since the late 1980s pursuant to an agreement with the Idaho Department of Environmental Quality (IDEQ). Potlatch has installed two different treatment/containment systems at the site to address the petroleum hydrocarbons that are present in the groundwater and seeping to the St. Joe River. In the early 1990s, Potlatch installed a groundwater recovery system in which contaminated groundwater was pumped from extraction wells to an oil/water separator. Recovered product was stored for later off-site disposal, and the recovered groundwater was re-injected upgradient of the site. By 2000, only 1,290 gallons of product had been recovered, and the seeps were still present. Because the groundwater pump and treatment system was not effective, in 2000 Potlatch removed it and installed an impermeable membrane along the bank of the St. Joe River to try to prevent the petroleum from seeping into the river. Behind the impermeable membrane, a recovery trench and extraction wells were installed for passive oil recovery. This system also failed to work; the seeps in the St. Joe River were still observed after the containment barrier was installed.

In 2007, the Potlatch Corporation entered into an Administrative Order on Consent (AOC) with EPA to perform an EE/CA at the site. Field work associated with the EE/CA was completed by Golder Associates, Inc., (Golder) of Redmond, Washington, in 2009, and Potlatch submitted a draft EE/CA report to EPA in January 2010 (Golder 2010). After receiving the draft EE/CA prepared by Potlatch/Golder, EPA decided to prepare its own EE/CA to address technical concerns and issues with the document.

Human health and ecological streamlined risk evaluations were performed for the EE/CA using analytical data collected during the 2007 EPA removal assessment and the 2009 field work performed by Potlatch/Golder. The results of the human health streamlined risk evaluation indicated that soil, groundwater, and surface water are impacted by site-related contamination. Numerous analytes in site media exceed health-based screening criteria, indicating that adverse health effects due to exposure to site-related contamination are possible. In particular, carcinogenic PAHs exceed screening criteria for all media. The results of the ecological risk evaluation indicated that surface water and sediment samples from the St. Joe River near the Avery Landing site are being impacted by petroleum contamination. In particular, diesel- and oil-range organics were frequently detected in sediment and occasionally in surface water. In addition, selected PAHs in sediment and surface water exceeded risk-based concentrations.

The scope of the proposed removal action is the reduction of petroleum product and hazardous substances to acceptable human health and ecological risk-based concentrations at the site. Removal action objectives (RAOs) developed for the site include removing the current non-functioning groundwater containment and extraction system; removing the bank and associated petroleum contamination; reconstruction of the bank; removal, treatment, and/or management of LNAPL and associated hazardous substances in the subsurface of the site; and proper off-site disposal of any waste streams developed during the removal action.

To achieve these objectives, the EE/CA identified removal action alternatives, including excavation of the contaminated soil, followed by either low-temperature thermal desorption (LTTD), soil washing, or off-site disposal of the contaminated materials. Another removal action alternative is replacement of the existing containment barrier and collection trench with a new one that is sufficient to capture the existing LNAPL plume.

The removal action alternatives were each analyzed individually and compared to each other based on effectiveness, implementability, and cost. Estimated full scale costs are $9.71 million for LTTD, $6.62 million for soil washing, $7.5 million for off-site disposal, and $4.41 million for containment and collection.

The recommended alternative for the removal action is LNAPL extraction followed by excavation and off-site disposal. This alternative was found to be effective and implementable. Off-site disposal was not the least costly alternative, but it was determined to be more flexible and reliable than soil washing, which must rely on determining the correct soil washing amendment during field trials. The least costly alternative was judged to be containment and collection. However, this alternative would require at least 30 years to implement, and variations of this approach have been already been applied to the site.

This page intentionally left blank.

Chapter 1 1 Introduction

The United States Environmental Protection Agency (EPA) has tasked Ecology and Environment, Inc., (E & E) to prepare this Engineering Evaluation/Cost Analysis (EE/CA) for the Avery Landing site in Avery, Idaho. An EE/CA is an analysis of removal action alternatives for a site. E & E performed the work under Superfund Technical Assessment and Response Team (START)-3 contract EP-S7-06-02, Technical Direction Document (TDD) 08-05-0006.

Soil, groundwater, surface water, and sediment at the Avery Landing site contain petroleum hydrocarbons and hazardous substances that are associated with the site's historical use as a railroad roundhouse and maintenance facility for the Chicago, Milwaukee, St. Paul, and Pacific Railroad (Milwaukee Railroad). Petroleum hydrocarbons (diesel and heavy oil) and other hazardous substances are present in subsurface soil and groundwater and are seeping into the St. Joe River, which is adjacent to the site.

Several owners have been identified for the site, including the Potlatch Corporation (Potlatch) and Larry Bentcik, and there is an ongoing effort by EPA to identify other site owners. In 2007, Potlatch entered into an Administrative Order on Consent (AOC) with EPA to perform an EE/CA at the site. Field work associated with the EE/CA was completed in 2009 by Golder Associates, Inc., (Golder) of Redmond, Washington, and Potlach submitted a draft EE/CA report to EPA in January 2010 (Golder 2010).

Commented [SH3]: EPA to provide update.

Include FHA and Shoshone County (per DEQ)?

After receiving the draft EE/CA prepared by Potlatch/Golder, EPA decided to prepare its own EE/CA. Because of several technical concerns and issues with the document, EPA determined that it was appropriate to assume responsibility for completion of the document. START prepared this EE/CA based on existing site information and data; no additional field investigation work was performed. This EE/CA was conducted in accordance with the criteria established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as well as sections of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) applicable to removal actions (40 Code of Federal Regulations [CFR] Section 300.415). Section 300.415(b)(4)(i) of the NCP requires that an EE/CA be completed for all non-time-critical removal actions. This EE/CA identifies the objectives of the removal action and analyzes the effectiveness, implementability, and cost of various alternatives that may achieve them. This EE/CA also provides information about the nature and extent of contamination and potential risks posed by the contaminants to human and ecological receptors. The EPA document *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA* (EPA 1993) was used in the preparation of this EE/CA.

Chapter 2 # 2 Site Characterization

Commented [SH4]: major reorganization here to address Duane's comments re the EE/CA guidance. Note, though, that I didn't follow the guidance exactly. Specific comments follow.

2.1 Site Description and Background

2.1.1 Site Location

The Avery Landing site is located in the St. Joe River Valley in the Bitterroot Mountains in northern Idaho, 1 mile west of the town of Avery in Shoshone County (Figures 2-1, 2-2, and 2-3). The site is directly adjacent to the St. Joe River to the south and Highway 50 to the north, and is at 47°14' 57" north latitude and 115° 49' 16" west longitude (Google Earth 2010). The site is located within the northeast quarter of Section 16, Township 45 North, Range 5 East, and the northwest corner of Section 15, Township 45 North, Range 5 East.

2.1.2 Type of Facility and Operational Status

The site was used as a switching and maintenance facility for the Milwaukee Railroad from 1907 until 1977. The facility included a turntable, roundhouse, machine shop, fan house, engine house, boiler house, storehouses, coal dock, oil tanks, and a pump house. Activities included refueling trains, using solvents to clean engine parts, cleaning locomotives with water, and maintaining equipment. The facility was located at the end of an electric rail line from the east; at the Avery facility, trains switched to fuel oil and/or diesel locomotives. Fuel oil was stored on site in a 500,000-gallon AST. The Milwaukee Railroad began to operate electric locomotives in the mid-1910s and continued until the mid-1970s, and transformer oil was reportedly stored at the Avery Landing site (URS 1993). During field investigations in 2007 and 2009, trace concentrations of PCBs were detected in subsurface soils, groundwater, and LNAPL (E & E 2007, Golder 2009)..

Figure 2-4 illustrates a historical railroad facility diagram, and Figure 2-5 presents this diagram superimposed on a recent aerial photograph of the site. The locations of relevant features are indicated and include the turntable, machine shop, cinder pit, boiler house, oil and coal bins, 50,000-gallon diesel and fuel oil AST (indicated as the "50' oil service tank" on Figures 2-4 and 2-5), other oil tanks, and associated piping.

The Milwaukee Railroad filed bankruptcy and then reorganized under the name CMC Real Estate Company (CMC). Under CMC, the properties were sold and otherwise divested (TAT n.d.). Potlatch acquired the western portion (Section 16) of the site in 1980 (Golder 2010), although there are reports that Potlatch attempted to purchase the entire site (including the eastern portion currently owned by Mr. Bentcik). Many of the former Milwaukee Railroad facilities, including the turntable, roundhouse, engine house, machine shop, and cinder pit, were located on the portion of the property obtained by Potlatch. After Potlatch acquired the land, Potlatch leveled and graded the property and then used it for temporary log storage. Portions of the property have also been leased to tenants for log storage, parking, and trailer sites (Golder 2010). The buildings and equipment associated with the former railroad maintenance facility were presumably demolished at some point after Milwaukee Railroad ceased operations, but it is not clear who performed the demolition, when it was performed, or how the demolition debris was disposed.

The eastern portion (Section 15) of the site reverted back to the family of the previous owner (before Milwaukee Railroad began operations), and this family sold the property to David

Thierault. In 1996, Mr. Thierault sold the property to Mr. Larry Bentcik, who currently owns the property (Bentcik 2007). Historical railroad facilities on the eastern portion of the site included an office, store house, oil pipes, and sand, coal, and oil storage. Apparently, the eastern portion of the site was where most of the rail car refueling occurred.

The original railroad grade along the northern edge of the site was acquired by the Federal Highway Administration for use in the construction and expansion of State Highway 50 (URS 1993). A portion of the site extends to the shoulder north of the highway, where the former railroad roundhouse AST was located, and where Potlatch re-injected untreated groundwater from the 1990s pump-and-treat system after processing through the oil/water separator.

The maintenance facility at the Avery Landing site was related to several other Milwaukee Railroad facilities approximately 0.75 miles east in the town of Avery. In the town itself was a passenger terminal and Substation No. 14, an electric substation that provided electricity for the electric rail line to the east.

2.1.3 Structures and Topography

South of the highway, the site is composed of two properties (Figure 2-3). The eastern portion (Section 15) is owned by Larry Bentcik, who maintains a vacation cottage and mule corral on the property. The western portion (Section 16) is owned by Potlatch. Until recently, there were several houses, motor homes, and motor home utility hook-ups. Several residents lived on the property year-round, and several more resided on the property seasonally. A domestic well was located on the Potlatch property for residential use. In 2009, Potlatch removed and/or demolished the residences and disconnected the trailer sites from the domestic well. The domestic well is reportedly disconnected and not in use (Golder 2010), but it apparently has not been plugged and abandoned in accordance with state regulations.

Numerous groundwater monitoring wells and "stick-up pipes" (polyvinyl chloride [PVC] pipes installed vertically in subsurface soil) are located on site. The stick-up pipes were used to monitor for the presence of light non-aqueous phase liquid (LNAPL) on groundwater during previous investigations. There are also several larger wells that had been used for the product recovery system installed for Potlatch. In the center of the site there is an above-ground storage tank (AST) and a shed on the concrete slab. The AST was used by Potlatch to store recovered product from the product recovery system operated from 1994–2000. Additionally, there are existing (and possibly historical) utilities, including above-ground and below-ground power lines, pipelines, and sewer lines.

There is little remaining at the site to indicate its previous use as a railroad roundhouse and maintenance facility, with the exception of a concrete slab and the remnants of rail lines leading to the former roundhouse. Presently, the site is on relatively flat ground with gravel and a small amount of vegetative growth. The site was largely composed of fill material as a result of construction of the railroad facility, and Potlatch performed additional leveling and grading after purchasing the property (URS 1993).

The elevation of the site is approximately 2,465 feet above mean sea level (Google Earth 2010). The site is on a flat, filled bank at a bend in the St. Joe River (Figures 2-2 and 2-3). The river valley is narrow and remote, and the immediate area around the site is largely rural, with some areas of residential and commercial use. Just across the highway to the north are steep mountain slopes.

2.1.4 Geology and Soil Information

The site is located within the Northern Rocky Mountain province along the south slope of the Bitterroot Mountains in the St. Joe River valley. The subsurface geology and geology of the surrounding hills is dominated by Precambrian (middle Proterozoic) sedimentary deposits including carbonates and quartzite which are part of the Piegan Group, also known as the Middle Belt Carbonate, Apple Creek Formation (Winston 2007). These deposits were part of an intracratonic basin that was periodically connected to the ocean system, and lacustrine and oceanic deposits can be found throughout the group (Ross and Villeneuve 2003, Link et al. 2007). The depth to bedrock at the site is unknown.

The site was developed along an active portion of the St. Joe River by in-filling from the steep canyon walls, which is evident from the coarse-grained angular gravels that are apparent in the upper 10-12 feet of fill across the site. The site has historically undergone extensive grading to make it a suitable location for a railroad facility. As such, the site is immediately underlain by unconsolidated sand and gravel fill materials existing from ground surface to about 12 feet below grade. At various site locations, debris including concrete, wood waste, scrap metal, asphaltic material, and pipes of various material and dimensions were encountered in test pit excavations. Approximately 700 feet of the river bank adjacent to the site was excavated and backfilled with fill soils and riprap rock placed on the riverside surface for armor to minimize bank erosion. Below the unconsolidated fill material are rounded gravels deposited by the St. Joe River in a high energy environment.

2.1.5 Hydrogeology

Commented [SH5]: Duane commented to put hydro in the geology and soils section, but I think this works better here.

The St. Joe River flows to the west along the site's southern boundary eventually discharging to Coeur d'Alene Lake, 60 miles to the west. Based on data collected at the Calder gauging station (located approximately 23 miles downstream from the site), during spring snow melt in May, the average river flow ranges from 7,000 and 8,000 cubic feet per second (cfs). In contrast, average river flows in September range from 400 and 500 cfs. Sudden storms, especially heavy rain or snow, can cause extreme river flows and flooding during warm periods in winter and spring. River flows have been measured as high as 30,000 to 50,000 cfs at Calder, Idaho. St. Joe River levels can fluctuate more than 8 feet in stage height at the Calder Station (USGS, National River Data Base, 2008).

Historically, groundwater elevations have typically ranged from approximately 10 to 16 feet bgs (Hart Crowser 2000a). Golder measured groundwater levels in September and November 2009 from existing site monitoring wells (including the wells that EPA installed in 2007) and four new monitoring wells that Golder installed in September 2009. In September 2009, depths to groundwater in the monitoring wells ranged from 8.6 to 18 feet bgs. In November 2009, depths to groundwater ranged from 8.8 to 16 feet bgs. Groundwater contour maps for September and November 2009 are included as Figures 2-6 and 2-7, respectively (Golder 2010). Groundwater level measurement summary tables from the 2007 and 2009 investigations are included in Appendix A.

The groundwater on the Bentcik portion of the site may be influenced by the river, such that river water may discharge into the Bentcik property. This is demonstrated by the April 2007 groundwater level measured in MW-5 (89.87 ft), which was higher than the groundwater level measured in EMW-02 (89.3 ft) and lower than EMW-01 (89.93 ft; E & E 2007). Based on a triangulation of equipotentials among those three 2007 measurements, it appears that river water is moving into the groundwater.

Short-term hydraulic slug tests were performed by Golder in 2009 to approximate the hydraulic conductivity of the aquifer beneath the site (Golder 2010; slug test results are included in Appendix A). Ultimately, the results of the slug test were to be used to evaluate the need and implementability for a long-term pump test. Slug tests were performed on seven monitoring wells during the period of September 8 through September 10, 2009. Overall, the total range in hydraulic conductivities was 0.31 to 5.16 feet per day (ft/day); however, the h/h0 versus time graph for HC-1R, with the highest hydraulic conductivity, has a noticeable dip at approximately t50, indicating that the analysis may not be as accurate. Without considering HC-1R, hydraulic conductivity values range from 0.31 ft/day to 3.59 ft/day. Spatially, the highest hydraulic conductivities occurred in monitoring wells GA-2, GA-3, and GA-4 located at the western end of the site, with the highest hydraulic conductivity measured at GA-2 (3.59 ft/day). The wells located on the eastern end of the property had lower hydraulic conductivities ranging from 0.31 ft/day (EMW-01) to 1.74 ft/day (EMW-02).

2.1.6 Surrounding Land Use and Populations

The site is within the narrow St. Joe River Valley, which is in the St. Joe National Forest District of the Idaho Panhandle National Forests. There are generally steep mountains to the north and south of the St Joe River, including directly north of Highway 50 from the site. Land uses in the area around the site are largely rural and recreational, which is consistent with its location surrounded by a national forest. The St. Joe River is a popular recreational waterway that is often used for kayaking, rafting, and fishing. There are several areas of commercial land nearby, including a motel and recreational vehicle park across the river.

2.1.7 Sensitive Species and Environments

The St. Joe River is used for wildlife habitat, recreation, and drinking water for downstream residents. According to the Idaho Administrative Procedures Act (IDAPA) 58.01.02.110.11, the segment of the St. Joe River adjacent to the Avery Landing site that could be impacted by contaminants found at the site has the following designations: special resource water, domestic water supply, primary contact recreation, cold water communities, and salmonid spawning (E & E 2007).

The Potlatch/Golder draft EE/CA describes the sensitive species in the area as follows:

> Historically, native game fish in the river include westslope cutthroat trout (*Oncorhynchus clarki lewisi)*, bull trout (*Salvelinus confluentus*), and mountain whitefish (*Prosopium williamsoni*; Idaho Department of Fish and Game). This section of the St. Joe River has been designated as a catch-and-release fishing area for cutthroat trout. Other

species of fish found in the river include bull trout, rainbow trout (*O. mykiss*) and Dolly Varden (*S. malma*).

The Site is located within Region 1, Hunting Unit 6 (Idaho Department of Fish and Game). In this management unit, the Department issues hunting permits for the following big game: Deer, Elk, Bear, Moose, and Wolves. In addition to big game, smaller game such as rabbits and furbearers are hunted as well as a wide variety of birds (water fowl and upland birds). (Golder 2010)

2.1.8 Meterology

This climate summary was prepared from data recoded at the nearby Avery Ranger Station Number 2 from 1968 through 2009. Avery has an average annual high temperature of 56.0 degrees Fahrenheit (°F) and an average low temperature of 35.2 °F. The warmest months are July and August, when average high temperatures are 83.1 and 83.8 °F, respectively, and average low temperatures are 49.4 and 49.2 °F, respectively. The coldest month is January, with an average high temperature of 30.3 °F and an average low temperature of 20.7 °F (WRCC 2010b).

The average annual precipitation from 1968 through 2009 was 37.31 inches. December and January receive the highest precipitation, with averages of 5.02 and 5.89 inches, respectively. July and August are the driest months with average precipitation amounts of 1.25 and 1.21 inches, respectively. Avery receives an annual of 75.6 inches of snowfall each year, with most falling in December and January (20.0 and 29.5 inches, respectively). Snowfall has been recorded from October though April (WRCC 2010b).

Average annual wind speed in the region (at the Coeur d'Alene airport) from 1996 to 2006 is 7.3 miles per hour (mph), with a range of 6.6 mph in August to 8.3 mph in March (WRCC 2010a).

2.2 Regulatory History and Previous Investigations

Commented [SH6]: There isn't a specific section like this in the EE/CA guidance, but I think this works much better here.

The earliest reported observation of petroleum seeps to the river from the Avery Landing site were documented in a letter from the Idaho Department of Health to Milwaukee Railroad in 1970. The letter reports Forest Service District Ranger observations that "at times oil coming from the Milwaukee Railroad roundhouse covers as much as one-third of the river surface in the vicinity of the spill" (Van't Hul 1970).

2.2.1 IDEQ Investigations, Late 1980s

In the late 1980s, the State of Idaho Division of Environmental Quality of the Idaho Department of Health (now IDEQ) began to investigate the site because of the presence of visible petroleum product seeps to the St. Joe River from the site riverbank. The investigation included installation of several monitoring wells and test pits in the late 1980s and early 1990s. These investigations determined that free product was a mixture of diesel and heavy oil and was present at the water table throughout the site, with product thicknesses exceeding four feet in some locations.

2.2.2 EPA Site Inspection, 1992

In 1992, URS Consultants, Inc., (URS) performed a site investigation at the site as a contractor to EPA. URS collected soil, groundwater, and surface water samples from the site and vicinity for laboratory analysis. The results indicated the presence of contaminants, including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and PCBs. Benzene, arsenic, and lead were detected in an on-site monitoring well at concentrations that exceeded the federal Maximum Contaminant Levels (MCLs; URS 1993).

2.2.3 Potlatch Product Recovery System, 1994

In 1994, Potlatch installed a product recovery system at the site, pursuant to an IDEQ Consent Decree. The system included several trenches installed near the bank of the river. Groundwater and product were pumped from these trenches and then sent through an oil/water separator. Recovered product was stored in an on-site AST for later off-site disposal. Recovered groundwater was pumped underneath Highway 50 and re-injected into the ground through an approximately 360-foot long re-infiltration trench installed north of the road. The system operated until approximately 2000 and recovered a total of 1,290 gallons of product (Farallon 2006).

2.2.4 Potlatch Product Containment Barrier, 2000

By 2000, despite the operation of the product recovery system, product seeps from the site were still observed on the banks of the St. Joe River. Under direction from IDEQ, Potlatch installed a restraining barrier along the bank in 2000 to help prevent free product from reaching the river. Potlatch excavated material away from the bank, installed a PVC liner to act as a barrier wall to prevent product seeps to the river, and backfilled with sand, gravel, and riprap along the bank. Potlatch also installed a series of product recovery trenches and wells to recover any free product that might collect against the barrier (Farallon 2006). With the new restraining barrier, Potlatch proposed to recover additional free product if product was present in site recovery wells at a thickness of 0.05 feet (0.6 inches) or greater. Potlatch continued to monitor the monitoring wells on site for free product, but the company never operated the product recovery system again (Cundy 2007).

2.2.5 Potlatch LNAPL Seep Maintenance, 2002 to Present

Beginning in 2002, IDEQ continued to observe product seeps to the St. Joe River originating from the site. IDEQ recommended that Potlatch place booms in the river to contain the seeps (Golder 2010). Although the booms were supposed to be deployed and maintained consistently while any seeps were present, actual boom deployment was intermittent and incomplete. On multiple occasions beginning in 2005, IDEQ and EPA observed LNAPL seeps to the river with no booms in place. Additionally, EPA has observed oil "blooms" rising from the river bed several feet away from the river bank. Furthermore, Potlatch's use of the booms was not subject to a comprehensive containment and LNAPL recovery plan or a schedule agreed upon with any agency.

2.2.6 EPA Removal Assessment, 2007

In a letter dated September 11, 2006, IDEQ requested the assistance of EPA to investigate the site and the continued petroleum seeps into the St. Joe River (IDEQ 2006). In 2007, EPA performed a removal assessment at the site to investigate the ~~potential~~ release of petroleum to surface waters of the United States in violation of OPA and potential releases of CERCLA hazardous substances and other environmental impacts related to the site’s past use as a railroad roundhouse, maintenance, and refueling facility. EPA installed 13 soil borings, of which six were completed as monitoring wells. The investigation focused on the eastern area of the site, including portions of both the Potlatch and Bentcik properties.

EPA observed petroleum hydrocarbons in surface water, groundwater, and subsurface soil throughout the site at levels that exceeded applicable state regulatory standards. Petroleum was observed floating on groundwater in monitoring and recovery wells with measurable product thicknesses up to 0.88 feet. Subsurface soils collected from soil borings were saturated with petroleum. EPA observed active petroleum seeps and "blooms" to the St. Joe River in violation of OPA and state regulations. An approximately 200-feet stretch of the site's river bank contained evidence of past-petroleum seep activity, including oil staining on rip rap at the water level. Analytical results confirmed the presence of diesel and heavy oil (bunker C), which was consistent with historical documentation about the nature of the petroleum releases. EPA's investigation also indicated the area of the free product plume was larger than previously estimated.

Subsurface soil and groundwater samples collected from the site contained several CERCLA hazardous substances (including carcinogenic polycyclic aromatic hydrocarbons [PAHs]) that exceeded applicable state and federal guidelines. Several metals (arsenic, iron, lead, manganese, and mercury) also exceeded applicable guidelines, but some of these metals may be naturally elevated in the region. The PCB Aroclor-1260 was detected in several site soil samples and in a sample of the petroleum product, and Aroclor-1260 exceeded the state guideline in one groundwater sample. The on-site domestic well, which is downgradient of the site's LNAPL plume area, contained concentrations of site contaminants, including anthracene, diesel-range organics (DRO), and arsenic.

In addition to the visible petroleum product seeps to the river, a sample of surface water contained four PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and chrysene) at concentrations that exceeded Idaho Risk Evaluation Manual guidelines, and the PAH benzo[a]pyrene also exceeded the federal ambient water quality criteria. When compared to sediment guidelines, PAH compounds detected in the soil samples exceeded several consensus-based sediment quality guidelines (E & E 2007).

2.2.7 Potlatch/Golder Draft EE/CA, 2009 to 2010

In 2008, Potlatch entered into AOC number 10-2008-0135 with EPA to complete an EE/CA for the Avery Landing site. Work associated with the EE/CA was completed by Golder as a consultant to Potlatch. As a part of the EE/CA, Potlatch agreed to perform additional characterization field work at the site. The scope of work for the additional field work was outlined in a work plan dated January 21, 2009 (Golder 2009).

The field work for the EE/CA was completed in the late summer and fall of 2009 and included the following tasks:

- Collection of subsurface soil samples from five boreholes that were installed at the northeastern portion of the site, near the former AST location and Highway 50;
- Excavation of six test pits from the LNAPL plume area for collection of contaminated site soils for soil wash treatability testing;

- Excavation of eight test pits, with the collection of associated subsurface soil samples, to characterize the western half of the site;
- Installation of four additional monitoring wells at the site, followed by water elevation gauging, free product observations, and groundwater sampling; and
- Collection of sediment and surface water samples from eight locations along the banks of the St. Joe River adjacent to the site.

The field work included the sampling of subsurface soil (from test pits and boreholes), groundwater (from existing and four newly installed monitoring wells), LNAPL (from groundwater wells and surface water seeps), sediment, and surface water. LNAPL was observed in subsurface soil, groundwater, sediment, and surface water. Analytical results indicated that DRO/heavy oils, SVOCs (including carcinogenic PAHs), PCBs, VOCs, and metals were detected in subsurface soil and sediment. DRO/heavy oils and carcinogenic PAHs were detected in groundwater. Surface water contained carcinogenic and non-carcinogenic PAHs and metals.

Based on observations recorded during field work, Golder updated the estimated extent of the LNAPL plume. Golder also observed evidence of buried debris and trash in the western half of the site.

A component of the Potlatch/Golder EE/CA investigation was a treatability study to evaluate soil washing as a potential treatment method for petroleum-contaminated soil. The results of the treatability study indicated that soil washing could effectively achieve removal efficiencies of 96 to 97 percent (%) for DRO and heavy-oil range hydrocarbons (ART 2009).

2.3 Previous Removal Actions

There have been no previous removal actions at the site.

2.4 Source, Nature, and Extent of Contamination

2.4.1 Location of Contaminants

A petroleum plume of heavy oil and diesel is present in subsurface soil and groundwater and is migrating toward, and discharging to, the St. Joe River. In addition to this petroleum-based LNAPL plume, organic contaminants (e.g., PAHs, VOCs, and PCBs) and metals are present in subsurface soil and groundwater at the site. The oil and diesel were released during historical site activities as a railroad roundhouse, maintenance, and fueling facility. Many of the contaminants are likely related to the LNAPL plume (especially the PAHs), and other contaminants are likely related to other historical site activities.

The extent of the LNAPL plume area has been monitored and estimated during previous investigations and cleanup activities performed on behalf of Potlatch. Figure 2-8 presents a summary of the estimated LNAPL plume area in 2000 (Hart Crowser 2000b). Figure 2-8 also includes the maximum LNAPL levels recorded in each site monitoring well and piezometer as compiled for the 2007 EPA removal assessment (E & E 2007).

The investigations performed by EPA in 2007 (E & E 2007) and Potlatch in 2009 (Golder 2010) included sampling of subsurface soil, and geologists recorded observations of any petroleum product observed in subsurface soil samples. Table 2-1 presents a summary of the observations of petroleum in subsurface soil from soil boreholes and test pits in 2007 and 2009. Copies of borehole logs from these investigations are included in Appendix B. This data is presented on Figure 2-9, which also presents the estimates of the extent of the LNAPL plume from 2000 (Hart Crowser 2000b), 2007 (EPA; E & E 2007), and 2009 (Potlatch; Golder 2010). In addition to the main LNAPL plume area, petroleum was also observed in subsurface soil from three discrete locations to the west, including test pits TP-03 and TP-06 and the borehole for monitoring well GA-3.

Table 2-2 presents a summary of LNAPL observations recorded in monitoring wells during the 2007 EPA (E & E 2007) and 2009 Potlatch (Golder 2010) investigations. The data was obtained from groundwater monitoring data obtained from each report (Appendix A). LNAPL was observed in several of monitoring wells in the estimated petroleum plume area. In several of the wells, the specific thickness of the monitoring wells could not be determined. In 2007, the thickness of LNAPL was observed as high as 0.88 feet in monitoring well HC-4. In 2009, LNAPL was observed as high as 3.73 feet in MW-11, although it is not clear how representative this measurement is because no water was detected at the bottom of the well. Monitoring well locations where free product was observed in 2009 are indicated on Figure 2-10.

This LNAPL plume area (Figures 2-9 and 2-10) extends from the former AST area in the northeast (north of Highway 50) to the south and west towards the St. Joe River. Major portions of the LNAPL plume area are on both the Bentcik (Section 15) and Potlatch (Section 16) properties. The southern boundary of the LNAPL plume area is contiguous with the bank of the St. Joe River. In addition to the contiguous petroleum plume area, smaller discrete areas of petroleum contamination were observed downgradient (i.e., to the west) of the plume area at TP-03, TP-06, and GA-3.

In addition to the LNAPL, a number of individual chemical compounds, including carcinogenic PAHs, PCBs, VOCs, and metals, have been detected at the site. Many of these detections are associated with the LNAPL plume area, although some of the compounds are also present in the western portion of the site, including test pits TP-02, TP-04, and TP-06.

2.4.2 Quantity of Contaminated Area

The LNAPL plume area and the discrete locations to the west (TP-03, TP-06, and GA-3) have a total area of approximately 5 acres. Contaminated soil begins at an average depth of 9 feet bgs, and there is an average thickness of 8 feet of LNAPL-contaminated soil. Cross sections and a three-dimensional image were developed using AutoCAD software. The cross sections are presented on Figures 2-11, 2-12, and 2-13. Using this information, the volume of the LNAPL plume area and the three discrete locations were calculated to be approximately 43,000 cubic yards. To yield a conservative estimate, a factor of 10% was added, increasing the volume to 47,300 cubic yards.

2.4.3 Targets Potentially Affected by the Site

Potential targets for contaminants at the site include current or potential future residents or visitors to the site. Currently, a seasonal cabin is located on the Bentcik property (Section 15 area). The Potlatch portion of the site (Section 16) has been used in the past for seasonal and year-round residences in the past and could be used for residential purposes again in the future unless restrictions are placed on the property. A domestic well was installed downgradient of the LNAPL plume area and was used to supply drinking water to residences on the Potlatch property. Although Potlatch reportedly disconnected and stopped using this domestic well (Golder 2009), the well has apparently not been properly plugged and abandoned and could presumably be used again in the future as a drinking water supply. Residents, workers, or visitors to the site could be exposed to subsurface contamination in the event of any subsurface disturbance through future construction work or improvements.

LNAPL seeps to sediment and surface water are ongoing. Potential targets include downstream human populations who may use the river for recreation (i.e., swimming or fishing) or for drinking water. Ecological receptors in sediment and surface water are also potential targets of the site contamination.

2.5 Analytical Data

This EE/CA relies primarily on analytical data gathered during the 2007 EPA removal assessment (E & E 2007) and the 2009 EE/CA-related field investigation performed on behalf of Potlatch by Golder (Golder 2010).

The EPA 2007 removal assessment included the collection of subsurface soil, groundwater, surface water, and LNAPL samples. EPA installed 13 soil borings in the area of the LNAPL plume area. Six of the borings were completed as monitoring wells. Subsurface soil samples were collected from the boreholes. Groundwater samples were collected from the newly installed monitoring wells and several existing monitoring wells. An LNAPL sample was collected from one of the existing wells. Three surface water samples were collected, including from areas near ongoing seeps. All samples were analyzed for VOCs, SVOCs, PCBs, total petroleum hydrocarbons (diesel and heavy oil range), and metals. Table 2-3 presents a summary of the samples collected for the EPA 2007 removal assessment, and the sample locations are indicated on Figure 2-14. Analytical data summary tables from the EPA 2007 removal assessment are presented in Appendix C. The results of the EPA removal assessment are summarized in Section 2.2.6.

Samples collected from the 2009 field activities performed by Potlatch/Golder are summarized in Table 2-4. Potlatch/Golder collected samples of surface and subsurface soil, groundwater, LNAPL, surface water, and sediment. Six test pits were excavated in the area of the petroleum plume for the purpose of collecting soil samples (combined into three composite samples) for treatability testing. An additional seven test pits were excavated in the western portion of the site. Five boreholes were installed in the area of the former UST location north of the present Highway 50. Four monitoring wells were installed downgradient of the petroleum plume area; groundwater samples were collected from new and existing wells, and LNAPL was collected from wells in the LNAPL plume area. Sediment and surface water samples were also collected from seven locations along the bank of the river. For the 2009 Potlatch/Golder field work, Figure 2-15 indicates test pit locations, Figure 2-15 indicates monitoring well and soil borehole locations, and Figure 2-16 indicates sediment and surface water sample locations.

All 2009 Potlatch/Golder samples were analyzed for NWTPH-DX, PCBs, PAHs, and TAL metals, and a subset of the samples were also analyzed for SVOCs and VOCs, as indicated in Table 2-4. The analytical data summary tables for the Potlatch/Golder samples are included in Appendix E. Analytical data from the Potlatch/Golder EE/CA was reviewed and assessed by a START chemist and found to be usable for this EPA EE/CA. Copies of the START data validation memoranda for the Potlatch/Golder data are included in Appendix D. The results of the 2009 Golder field work are summarized in Section 2.2.7.

Based on the results of the 2007 and 2009 field sampling events, the following types of chemical compounds were detected in site media, as summarized below.

> **Subsurface Soil**: DRO, heavy oil-range organics, PCBs, carcinogenic PAHs, non-carcinogenic PAHs, SVOCs, VOCs, metals.
>
> **Groundwater**: DRO, heavy oil-range organics, PCBs, carcinogenic PAHs, non-carcinogenic PAHs, and other metals.
>
> **Sediment**: DRO, heavy oil-range organics, PCBs, carcinogenic PAHs, non-carcinogenic PAHs, VOCs, metals.
>
> **Surface Water**: carcinogenic PAHs, non-carcinogenic PAHs, metals.

2.6 Streamlined Risk Evaluation

2.6.1 Conceptual Site Model

Human Health

The purpose of a conceptual site model (CSM) is to provide a graphic representation of site conditions as they relate to human health and ecological risk evaluation. A CSM is prepared by evaluating historical use of the site and surrounding areas. Environmental conditions at the site, including ground conditions and hydrogeology, are also evaluated. The model is used to facilitate selection of removal alternatives and to evaluate the effectiveness of removal actions in reducing human and environmental exposure. The CSM:

- Identifies the primary source of contamination in the environment (e.g., historical site activities related to railroad maintenance, refueling, and petroleum spills);
- Shows how chemicals at the original point of release might move in the environment (e.g., seepage to surface water);
- Identifies the different types of human and ecological populations (e.g., recreational visitors, residents, aquatic species) that might come into contact with contaminated media; and
- Evaluates the possibility of those receptors incorporating the contaminants into their bodies by identifying potential exposure pathways (e.g., ingestion of contaminated soil, inhalation of particulates, dermal contact with contaminated soil) that may occur for each human or environmental population.

In a risk evaluation, exposure pathways are the means by which hazardous substances move through the environment from a source to a point of contact with people or ecological receptors. An exposure pathway must be considered complete for exposure and subsequent risks to occur. A complete pathway must include the following elements (EPA 1989):

- A source and mechanism for release of constituents;
- A transport or retention medium;
- A point of potential contact (exposure point) with the affected medium; and
- An exposure route.

If one of the above elements is missing, the exposure pathway is not considered complete and is not evaluated in the risk evaluation. The CSM for the Avery Landing site is presented in Figure 2-17.

Ecological Receptors

The CSM in Figure 2-17 includes a preliminary ecological CSM for the site. Fish, benthic invertebrates, and other aquatic organisms in the St. Joe River may be exposed to site-related chemicals through direct contact with contaminants of concern (COCs) or with water and sediments contaminated by COCs; ingestion of COCs or water or sediments contaminated by COCs; and ingestion of contaminated food (e.g., sediment- or soil-dwelling insects or vegetation). Wildlife species that obtain all or part of their food from the St. Joe River may be exposed to site-related chemicals from ingestion of COCs or from water or sediment contaminated by COCs, or by ingestion of contaminated food (other plant or animal species that have been contaminated by COCs). Terrestrial wildlife species could be exposed to chemicals in surface water from the St. Joe River while drinking; however, drinking typically is an insignificant route of exposure for wildlife, especially when chemical concentrations in surface water are generally low, as they are at this site (see Section 2.6.3.6).

2.6.2 Streamlined Human Health Evaluation

The human health screening level evaluation provides an initial indication of the possibility of adverse human health effects due to exposure to site-related contamination. Information on the exposure pathways and screening values used for evaluation is presented below, followed by a discussion of the screening results.

2.6.2.1 Receptors and Exposure Routes

Human receptors at the site may be exposed to site-related contamination via contact with soil, surface water, groundwater, indoor air, or fish or other biota (see CSM; Figure 2-17). Routes of exposure include ingestion, dermal absorption, and inhalation. A detailed description of all complete exposure pathways and receptors is provided below.

The banks of the river are very steep and the current moves swiftly. Additionally, the bank adjacent to the LNAPL plume area is covered in rip rap. Therefore, it is unlikely that residents or recreational users would contact sediment. Therefore, sediment exposure was not considered to be a complete exposure pathway and is not evaluated for this human health evaluation.

Residents
The Bentcik portion of the site includes a cottage that is currently occupied seasonally as a vacation home. Seasonal cabins and year-round residences were once located on site, and there is currently nothing to preclude reestablishment of seasonal and/or year-round residences at the site. Therefore, a full-time resident was considered for this evaluation. Residents may be exposed to site-related contamination in soils via incidental ingestion, dermal contact, or inhalation of soil particulates. In addition, a groundwater supply well is currently located on the site. While this domestic well has been disconnected from the trailer site connections and is reportedly not in use, nothing currently precludes future use of this well, or the installation of another domestic well, as a source of household water. Therefore, exposure to groundwater via ingestion and dermal contact was considered. In addition, volatile chemicals may migrate from the subsurface soils, groundwater, and LNAPL into homes, resulting in inhalation exposure to volatile chemicals.

IDEQ has designated the St. Joe River as a source of water for domestic use (IDEQ 2010). While there are no public water supply intakes in the area of the site, the possibility exists that future residents may draw water from the river for household use. For this reason, surface water ingestion and dermal contact is considered a complete exposure pathway. In addition, residents may ingest contaminated fish caught from the St. Joe River.

Recreational Users
It is assumed that a recreational user visits the site occasionally to fish or hunt, and hikers and trespassers may also visit the site. Typically a recreational user is exposed to fewer media than a permanent resident. However, the Bentcik family currently uses the home on the site when they visit the area for recreation. Therefore, all exposure pathways considered for the resident are also considered for a recreational user, with the exception of subsurface soil direct contact. However, the exposure frequency (how often the site is used for recreation) would be considerably less than the exposure frequency for a resident.

2.6.2.2 Screening Values
For this evaluation, the maximum value detected at the site in each media was compared to media-specific risk-based screening levels. Details on the selection of appropriate screening values are provided below.

Soils
Initial Default Target Levels (IDTLs) published in the Idaho Risk Evaluation Manual (IDEQ 2004) were used as screening values for site soils for this EE/CA. IDTLs are risk-based concentrations derived from standardized equations that combine default exposure assumptions with EPA toxicity data. The IDTLs are considered to be protective for humans over a lifetime and meeting these levels allows unrestricted (residential) use of the property. IDTLs for soil are the lowest of the following concentrations:

- *Surficial* soil concentrations protective of exposures via *groundwater ingestion* at EPA MCL or equivalent risk-based concentrations at the downgradient edge of the source,
- *Subsurface* soil concentrations protective of exposure via *groundwater ingestion* at MCL or risk-based concentrations at the downgradient edge of the source,

- *Subsurface* soil concentrations protective of exposure via *indoor inhalation* of vapors emanating from soil for a residential scenario (e.g., child or age-adjusted receptor), and
- *Surficial soi*l concentrations protective of *combined ingestion, dermal contact, and outdoor inhalation* exposures for a residential scenario (IDEQ 2004).

For several chemicals, IDTLs were not available. For these chemicals, EPA's *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (EPA 2010) for residential exposure were used for screening purposes. In the case of petroleum hydrocarbons (diesel range organics and heavy oils), IDTLs or Regional Screening Levels (RSLs) were not available.

Any building or excavation of the site may result in subsurface soils being brought to the surface. Therefore, subsurface and surface soils were considered together for this evaluation.

Groundwater
IDTLs were also used as screening values for groundwater. IDTLs for groundwater are the lowest of the following concentrations:

- The maximum value detected for chemicals having MCLs or calculated values for ingestion of water by either a child, an adolescent, an adult, or an age-adjusted individual in a residential scenario, or
- Groundwater concentrations protective of indoor inhalation for a residential scenario (e.g., child or age-adjusted receptor; (IDEQ 2004).

For several chemicals, groundwater IDTLs were not available, so EPA's RSLs were used for screening purposes. In the case of petroleum hydrocarbons (DRO and heavy oils), IDTLs or RSLs were not available.

Surface Water and Consumption of Aquatic Organisms
As stated previously, IDEQ has designated the St. Joe River as a source of water for domestic use. Several screening metrics were used for evaluation of surface water. First, IDEQ's Water Quality Standards (IDAPA 58.01.02) were used. There are two water quality standards based on human consumption. The first standard is based on the assumption that surface water is used as a domestic water supply and that organisms living in the surface water may be consumed. The second value is based on consumption of organism only (recreational use). Both values were developed for the protection of human health and are based on exposure and toxicity information.

Water quality standards were not available for a number of COCs. However, because the St. Joe River may be a source of drinking water, IDTLs for groundwater were also used for surface water screening. The use of IDTLs for surface water screening allows a more complete evaluation of surface water and thus ensures that human health is protected. If an IDTL was not available, EPA RSLs were used (EPA 2010). There are no IDTLs for petroleum hydrocarbons

2.6.2.3 Screening Evaluation Results
Maximum concentrations of chemicals detected in each media were compared with health-based screening levels. Tables 2-5, 2-6, and 2-7 provide the maximum detected value, the screening

criteria, and the result of the screening for soils, groundwater, and surface water, respectively. In addition, the frequency of exceedance (FoE) of screening levels is included to provide an indication of the extent of contamination. Results for each medium are provided below.

Soils

Table 2-5 provides soil screening results for the human health evaluation. Residents and recreational users may be exposed to site soils via incidental ingestion, dermal contact, inhalation of particulates, or inhalation of volatile chemicals emanating from subsurface soils into structures. Maximum soil concentrations exceeded screening levels for a number of chemicals, including some metals, VOCs, PAHs, petroleum fractions, and SVOCs. Of particular concern is the number of samples that exceeded screening levels for benzo(a)pyrene (a known carcinogen) and bulk petroleum products. Results indicate benzo(a)pyrene screening level concentrations were exceeded in 11 of 56 samples. Other carcinogenic PAHs, including benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene, also exceeded criteria but at a much lower frequency (1 of 56 samples for each). Two non-carcinogenic PAHs also exceeded screening levels: naphthalene (7 of 56 samples) and 2-methylnaphthalene (8 of 56 samples).

Several VOCs, including some known carcinogens, exceeded screening levels, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, sec-butylbenzene, benzene, methylene chloride, xylenes, and trichloroethene. The FoE for the volatile organics ranged from one to three exceedances out of 24 or 35 samples. DRO and heavy oils exceeded screening values in 13 of 54 samples each.

PCBs were detected in several site soil samples, but the concentrations did not exceed site screening levels.

Numerous metals exceeded screening levels. However, many of these metals may be naturally elevated in the area and metals in soil are not considered to be COCs.

The results of the soil screening evaluation indicate that numerous chemicals exceeded health-based screening criteria.

Groundwater

Table 2-3 provides groundwater screening results for the human health evaluation. Residents and recreational users may be exposed to groundwater via ingestion, dermal contact, and inhalation of volatile chemicals emanating from groundwater into structures. Exceedances were noted for bulk petroleum products, Aroclor 1260, several carcinogenic and non-carcinogenic PAHs, and metals. The highest FoE was noted for DRO (10 of 21 samples) and heavy oils (nine of 21 samples). The carcinogenic PAHs benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene exceeded criteria in one to two samples out of 21 samples analyzed. While the FoE was low for the carcinogenic PAHs, the maximum detected values where far greater than the health-based screening level, particularly for benzo(a)anthracene (1.6 micrograms per liter [µg/L] vs. 0.0765 µg/L). Several non-carcinogenic PAHs also exceeded screening, including 1-methylnaphthalene (5 of 21 samples) and 2-methylnaphthalene (1 of 21 samples). The SVOC n-nitrosodiphenylamine (1 of 9) exceeded criteria, as did arsenic (10 of 21), cobalt (2 of 21), lead (1 of 21) and manganese (13 of 21).

The results of the groundwater screening evaluation indicate that numerous chemicals exceeded health-based screening criteria.

Surface Water and Aquatic Organisms

Table 2-4 provides surface water screening results. The St. Joe River is considered a domestic use water body. Thus, residents and recreational users may be exposed to surface water via ingestion, dermal contact, and ingestion of aquatic organisms. Free product is present in surface water, which is a violation of state regulations. Surface water domestic water supply criteria were exceeded for the carcinogenic PAHs benzo(a)anthracene, benzo(a) pyrene, benzo(b)fluoranthene, and chrysene, with an FoE of one to two samples out of 11 collected. Surface water screening values based on consumption of aquatic organisms only were not exceeded.

The results of the surface water screening evaluation indicate that several chemicals exceeded risk-based screening criteria based on domestic use of surface water. Screening criteria were not exceeded based on recreational use of the site, including ingestion of aquatic organisms. Results of screening indicate that additional action is not necessary to protect recreational users who contact surface water or ingest aquatic organisms.

2.6.2.4 Uncertainties

Noteworthy sources of uncertainty in this streamlined human health risk evaluation include:

- Risk-based screening soil values are not available for some chemicals detected at the site, including 4-isopropyltoluene, N-propylbenzene, 2-hexanone, bis(2-chloroethoxy)methane, and carbazole. Groundwater screening levels were not available for 4,6-dinitro-2-methylphenol or carbazole in groundwater. However, because most of these chemicals were detected infrequently and were found at low levels they are unlikely to pose a threat to human health at the site.

- Surface water standards for recreational use (including ingestion of aquatic organisms) were not available for the majority of chemicals. These chemicals could not be screened for this evaluation. However, humans are unlikely to contact surface water on a regular basis and the absence of surface water standards for some of the chemicals detected in site surface waters are unlikely to have an appreciable effect on the evaluation conclusions.

- The detection limits were above screening values for some analytes in some samples, while other samples had detection limits below the screening level. This was the case with PAHs in soils and bulk petroleum products in surface water samples. However, for these COCs, at least some of the samples with detection limits below the screening level exhibited concentrations above the screening level. Thus these chemicals were selected as COCs. The detection limit variations may impact the FoE but not the selection of COCs, and thus the impact on the evaluation is minimal.

2.6.2.5 Conclusions of the Human Health Risk Evaluation

Soil, groundwater, and surface water show evidence of being impacted by site-related contamination. Numerous analytes in all media exceed health-based screening criteria, indicating that adverse health effects due to exposure to site-related contamination are possible. In particular, diesel- and oil-range organics and carcinogenic PAHs exceeded screening criteria for all media and some metals exceeded screening levels in soils and groundwater. Further action is warranted to reduce the risk to human populations that may use the site.

2.6.3 Streamlined Ecological Risk Evaluation

2.6.3.1 Site Ecological Characteristics

The Avery Landing site is located along the north shoreline of the St. Joe River in Avery, Idaho. The site is 640 meters long from east to west and extends inland from the river for a distance of 40 to 100 meters. The site has been used for commercial and transportation (railroad) purposes for many decades and is highly disturbed. Most of the site is covered by gravel or dirt roads and surfaces and mowed areas. One seasonal residence, a shed, and an AST are currently located on the site. As a result of its disturbed nature and ongoing human use, the site has limited value as habitat for plants and wildlife.

The St. Joe River forms the southern boundary of the site. According to IDEQ (2010), the St. Joe River is considered a special resource water. It supports cold-water fish communities and provides spawning habitat for salmon and trout. In addition, the river near the site is considered suitable for primary contact recreation and domestic water supply. Overall, the river appears to be a high-quality aquatic habitat capable of supporting a wide variety of benthic invertebrates and fish as well as wildlife species that use aquatic habitats to satisfy their food and habitat needs. Wildlife species expected to use the St. Joe River near the site include waterfowl, wading birds, shorebirds, and fish-eating mammals. The bull trout is a federally endangered species that is found in the St. Joe River. Additionally, State of Idaho species of concern found in the river include the bull trout, Westslope cutthroat trout, and Coeur d'Alene salamander.

2.6.3.2 Ecological Receptors

As noted above, because the site is disturbed and experiences ongoing human use, its value as habitat for plants and wildlife is limited. Some common terrestrial wildlife species may visit the site, but the site does not provide adequate cover and food to support a diverse and abundant wildlife community. In contrast, the St. Joe River is considered a high-quality aquatic habitat and likely supports diverse and abundant communities of benthic invertebrates, fish, and other aquatic organisms, and provides habitat and food for semi-aquatic wildlife.

2.6.3.3 Preliminary CSM

Figure 2-11 provides a preliminary ecological CSM for the site featuring the ecological receptor groups identified in the previous section. Aquatic vegetation, fish, benthic invertebrates, and other aquatic organisms in the St. Joe River may be exposed to site-related chemicals in the following ways: (1) direct contact with and ingestion of contaminants at product seeps; (2) direct contact with and ingestion of contaminated water and sediment; and (3) through the food chain (i.e., by consuming plant and animal materials that have accumulated site-related chemicals). Wildlife species that obtain all or part of their food from the St. Joe River near the site may be also exposed in these ways. Exposure of terrestrial plants and wildlife to site-related chemicals is possible in areas along the shoreline where oiled vegetation has been observed, but these areas are limited in extent.

2.6.3.4 Assessment Endpoints and Measures

In ecological risk evaluations, assessment endpoints are expressions of the ecological resources that are to be protected (EPA 1997). An assessment endpoint consists of an ecological entity and a characteristic of the entity that is important to protect. According to EPA (1998), assessment endpoints do not represent a desired achievement or goal, and should not contain words such as protect or restore, or indicate a direction for change such as loss or increase. Assessment endpoints are distinguished from management goals by their neutrality (EPA 1998). Measurements used to evaluate risks to the assessment endpoints are termed "measures" and may include measures of effect (e.g., results of toxicity tests), measures of exposure (e.g., chemical concentrations in sediment), and/or measures of ecosystem and receptor characteristics (e.g., habitat characteristics; EPA 1998). Based on the site ecology, site-related chemicals, and preliminary CSM, the ecological resources potentially at risk at the Avery Landing site are those associated with the St. Joe River, including aquatic vegetation, fish, benthic invertebrates, wildlife that obtain all or part of their food from the river, and terrestrial plants and animals in shoreline areas where product seeps have been observed. The assessment endpoints and measures for these receptor groups are stated below.

Aquatic Vegetation Community

Assessment Endpoint: Sustainability (survival, growth, and reproduction) of the aquatic macrophyte community in the St. Joe River near the site.

Measure: Measured concentrations of site-related chemicals in surface water from the St. Joe River near the site compared with water quality standards and benchmarks.

Benthic Invertebrate Community

Assessment Endpoint: Sustainability (survival, growth, and reproduction) of the benthic invertebrate community in the St. Joe River near the site.

Measure: Measured concentrations of site-related chemicals in sediment from the St. Joe River near the site compared with sediment benchmarks for effects on benthic invertebrates.

Fish Community

Assessment Endpoint: Sustainability (survival, growth, reproduction) of the fish community in the St. Joe River near the site.

Measure: Measured concentrations of site-related chemicals in surface water from the St. Joe River compared with water quality standards and benchmarks.

Semi-aquatic and Riparian Wildlife

Assessment endpoint: Sufficient rates of survival, growth, and reproduction of herbivorous, piscivorous, and benthivorous birds and mammals to sustain healthy populations along the St. Joe River near the site.

Measure: None. Modeling food-chain uptake and dietary exposure for semi-aquatic wildlife is beyond the scope of this streamlined evaluation.

Terrestrial Riparian Plant Community
Assessment endpoint: Sustainability (survival, growth, and reproduction) of the shoreline terrestrial plant community at the site.

Measure: None. Soil samples were not collected from shoreline areas where product seeps were occasionally observed.

2.6.3.5 Data Sources
To assess potential ecological risks, this streamlined evaluation uses surface water and sediment samples collected from the St. Joe River near the site.

2.6.3.6 Surface Water Screening Results
Eleven surface water samples were collected from the St. Joe River at the site (see Section 2.5 for sampling locations). The samples were analyzed for PAHs, other SVOCs, diesel- and oil-range organics, and selected metals. Table 2-8 lists the chemicals that were detected in at least one sample, frequency of detection, maximum detected concentration, and water quality standards and benchmarks for protection of aquatic life. State of Idaho water quality standards were used preferentially. If an Idaho standard was not available for a chemical, then an alternate surface water benchmark for that chemical was taken from Suter and Tsao (1996). Only one organic compound, benzo(a)pyrene, in one sample was detected at a concentration in excess of its water quality standard or benchmark. Diesel- and oil-range organics were detected in two samples and one sample, respectively. There are no water quality standards for these parameters. Only one metal, manganese, exceeded its water quality standard. The manganese may be from natural sources. Overall, the surface water data suggest that petroleum contamination in subsurface soil and groundwater at the site may be reaching the St. Joe River, but the level of impact in the site vicinity appears to be low.

2.6.3.7 Sediment Screening Results
Sixteen sediment samples were collected from the St. Joe River at the site (see Section 2.4 for sampling locations). The samples were analyzed for PAHs, other SVOCs, DRO, heavy oils, PCBs, and metals. Table 2-9 lists the chemicals that were detected in at least one sample, frequency of detection, maximum detected concentration, and sediment screening levels for protection of freshwater benthos. Regional Sediment Evaluation Team (RSET 2006) screening levels for freshwater sediments in the Pacific Northwest were used preferentially. If a RSET (2006) screening level was not available, then an alternate screening level for that chemical was taken from MacDonald et al. (1999). Two metals, arsenic and lead, marginally exceeded their screening levels. Antimony greatly exceeded its screening level. It is unclear whether these metals are associated with subsurface petroleum contamination at the site. Diesel-range organics and heavy oil were frequently detected. There are no freshwater sediment standards for these parameters. Two PAHs, acenaphthene and fluorine, exceeded their respective screening levels, but only marginally. Overall, the sediment data suggest that petroleum contamination in subsurface soil and groundwater at the site may be reaching the St. Joe River.

2.6.3.8 Uncertainties

Noteworthy sources of uncertainty in this streamlined risk evaluation include:

- No ecological risk-based concentrations are available for diesel- and oil-range organics in surface water and sediment. As a result, the potential risks posed by these substances to aquatic life in the St. Joe River cannot be quantitatively assessed. However, this is not considered to be a significant shortcoming of the streamlined risk evaluation because the most toxic constituents of petroleum, PAHs, were evaluated.

- Not all chemicals detected in surface water and sediment at the site have risk-based screening values available. For example, no benchmarks are available for most substituted benzenes, substituted phenol, and SVOCs detected in sediment at the site (see Table 2-8 under *Other Organic Chemicals*). However, because these chemicals were detected infrequently, were found at low levels, and are not highly persistent, it seems unlikely that they would pose a significant ecological risk at the site.

- Modeling food-chain uptake and dietary exposure of site-related chemicals for semi-aquatic and riparian wildlife was beyond the scope of this streamlined evaluation. However, in order for potential wildlife risks at the site to be significant, the extent of petroleum contamination in the St. Joe River would need to be large and the concentration of PAHs would need to be high. Such a situation does not appear to exist at this site based on the available data on surface water and sediment.

- Potential risks to aquatic biota and benthic invertebrates were not assessed directly. Instead, the streamlined risk evaluation relied on comparing surface water and sediment data with standards and benchmarks. These comparisons are conservative because the standards and benchmarks are designed to be protective of the most sensitive aquatic species. Hence, potential risks to aquatic vegetation, fish, and benthic invertebrates at the site may have been overestimated by the measures used to evaluate these assessment endpoints.

2.6.3.9 Conclusions of Ecological Risk Evaluation

Surface water and sediment samples from the St. Joe River near the Avery Landing site show evidence of being impacted by petroleum contamination. In particular, diesel- and oil-range organics were frequently detected in sediment and occasionally in surface water. In addition, selected PAHs in sediment and surface water exceeded risk-based concentrations. Furthermore, oiled vegetation has been observed along the shoreline in some areas.

2.6.4 Contaminants of Concern

Petroleum product is seeping to the St. Joe River in violation of OPA and Idaho regulations. The petroleum product is also present in subsurface soil and on the groundwater as LNAPL, where it is present in excess of State of Idaho thresholds (0.01 feet). The observations of product and LNAPL are supported by analytical data, which indicated that diesel-range organics and heavy oil in site media. Therefore, the primary COC for the site is the petroleum.

Commented [SH7]: Earl, I added this section. What do you think?

Additionally, CERCLA hazardous substances, including carcinogenic PAHs, are present in site media above screening levels. The results of the human health and ecological streamlined risk evaluations indicate that site contaminants are impacting site media. Many of these CERCLA hazardous substances, including the PAHs, are associated with petroleum and are considered secondary COCs.

To address the human health and ecological risk concerns, the removal action should include the removal, management, and/pr treatment of petroleum-contaminated soils and petroleum present as LNAPL from the groundwater table. As per State of Idaho regulations, LNAPL should be removed to less than 0.01 feet from groundwater and surface water. A removal action to address LNAPL in groundwater and subsurface soils will also reduce further releases of petroleum seeps to the St. Joe River and the ongoing releases of associated hazardous substances.

insert 1 of 4; 8.5 X 11

Table 2-1 Human Health Evaluation Soil Screening Results

insert 2 of 4; 8.5 X 11

Table 2-1 Human Health Evaluation Soil Screening Results

insert 3 of 4; 8.5 X 11

Table 2-1 Human Health Evaluation Soil Screening Results

insert 4 of 4; 8.5 X 11
Table 2-1 Human Health Evaluation Soil Screening Results

Insert 1 of 3

Table 2-3 Human Health Evaluation Groundwater Screening Results

Insert 2 of 3

Table 2-3 Human Health Evaluation Groundwater Screening Results

Insert 3 of 3

Table 2-3 Human Health Evaluation Groundwater Screening Results

Insert 1 of 2

Table 2-4 Human Health Evaluation Surface Water and Aquatic Organisms Screening Results

Insert 2 of 2

Table 2-4 Human Health Evaluation Surface Water and Aquatic Organisms Screening Results

Insert 1 of 2

Table 2-5 Ecological Evaluation Surface Water Screening Results

Insert 2 of 2
Table 2-5 Ecological Evaluation Surface Water Screening Results

Insert 1 of 4

Table 2-6 Ecological Evaluation Sediment Screening Results

Insert 2 of 4

Table 2-6 Ecological Evaluation Sediment Screening Results

Insert 3 of 4

Table 2-6 Ecological Evaluation Sediment Screening Results

Insert 4 of 4

Table 2-6 Ecological Evaluation Sediment Screening Results

This page intentionally left blank.

Insert 1 of 1

Figure 2-1 Site Location Map

Insert 1 of 1

Figure 2-2 Site Vicinity Map

Insert 1 of 1

Figure 2-3 Site Layout Map

Insert 1 of 1

Figure 2-4 Groundwater Elevations and Contours, September 1, 2009

Insert 1 of 1

Figure 2-5 Groundwater Elevations and Contours, November 19, 2009

Insert 1 of 1

Figure 2-6 Historical Railroad Facility Layout

Insert 1 of 1

Figure 2-7 Sample Locations from 2007 EPA Removal Assessment

Insert 1 of 1

Figure 2-8 Test Pit Locations from 2009 Potlatch/Golder Field Work

Insert 1 of 1

Figure 2-9 Monitoring Well and Soil Borehole Sample Locations from 2007 EPA Removal Assessment and 2009 Potlatch/Golder Field Work

Insert 1 of 1

Figure 2-10 Sediment and Surface Water Station Locations from 2009 Potlatch/Golder Field Work

Insert 1 of 1

Figure 2-11 Conceptual Site Model for Human and Ecological Streamlined Risk Evaluation

This page intentionally left blank.

Insert 1 of 1

Figure 2-12 LNAPL Plume Area Estimates (2000, 2007, and 2009) and Product Observations in Soil Borings and Test Pits (2007 and 2009)

Insert 1 of 1

Figure 2-13 LNAPL Plume Area Estimates (2000, 2007, and 2009) and LNAPL Observations in Monitoring Wells (2009)

Insert 1 of 1

Figure 2-14 Contaminant of Concern Exceedances in Soil Samples Outside LNAPL Plume Area

Chapter 3 3 Identification of Removal Action Objectives

This section presents the objectives for the proposed removal action. In addition, this section includes a description of the statutory limits on removal actions, the scope of the removal action, a description of compliance with potential applicable or relevant and appropriate requirements, and the general schedule for removal activities.

3.1 Statutory Limits on Removal Actions

To the extent that a private entity undertakes the proposed CERCLA removal action, the statutory limits discussed below for Fund-financed removal actions do not apply.

CERCLA Section 104(c)(1) set limits of $2 million and 12 months for Superfund-financed removal actions. Cost and implementation time exemptions may be granted if EPA determines that the removal action is necessary to mitigate an immediate risk to human health, welfare, or the environment or that the removal action is otherwise appropriate and consistent with anticipated long-term remedial action. Funds expended to conduct an EE/CA are CERCLA §104(b)(1) monies and are not counted toward the $2 million statutory limit for removal actions.

3.2 Determination of Removal Scope and Objectives

3.2.1 Removal Action Scope

The scope of the proposed removal action is the reduction of petroleum product and hazardous substances to acceptable human health and ecological risk-based concentrations at the Site.

The scope corresponds to the following removal factors:

- Section 300.415(b)(2)(i) which identifies "actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;" and

- Section 300.415(b)(2)(ii) which identifies "actual or potential contamination of drinking water supplies or sensitive ecosystems."

3.2.2 Removal Action Objectives

Based on the scope of the removal action, the following removal action objectives have been developed for the Site:

- Remove the existing non-functioning groundwater containment, collection, and extraction system;

- Remove any petroleum product and hazardous substances from the St. Joe River bank;

- Reconstruct the St. Joe River bank;

- Remove, treat, and/or manage petroleum free product that is present as LNAPL on surface water or groundwater at greater than one-tenth (0.1) inch;

- Remove, treat, and/or manage soil and sediment contaminated by the petroleum free product and hazardous substances to prevent human and ecological exposures to risk-based concentrations by direct contact and incidental ingestion;

- Dispose of waste streams in accordance with CERCLA's Off-site Rule requirements.

These objectives will be achieved by meeting specified cleanup levels while working within the statutory limits and attaining potential applicable or relevant and appropriate requirements (ARARs) to the extent practicable.

3.3 Applicable or Relevant and Appropriate Requirements

Commented [SH8]: Should we add OPA to the ARARs?

Potential ARARs have been screened to aid in technology and alternative evaluation. For this response, on-site actions must comply with the substantive requirements of any identified ARARs, to the extent practicable considering the exigencies of the situation. On-site actions do not have to comply with the corresponding administrative requirements such as permit applications, reporting, and recordkeeping. Off-site actions must comply with all legally applicable requirements.

ARARs are divided into the following categories:

- **Chemical-specific requirements** are health- or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants.

- **Action-specific requirements** are controls or restrictions on particular types of activities, such as hazardous waste management or wastewater treatment. Examples of action-specific requirements would be state and federal air emissions standards as applied to an in situ soil vapor extraction treatment unit.

- **Location-specific requirements** are restrictions on activities that are based on the characteristics of a site or its immediate environment. An example would be restrictions on work performed in wetlands or wetland buffers.

The potential chemical-, location-, and action-specific ARARs for the EE/CA are summarized in Appendix E.

3.4 Determination of Removal Schedule

The general schedule for removal activities, including both the start and completion time for the non-time-critical removal action, will be subject to a negotiated Administrative Order on Consent with PRPs.

Insert 1 of 2

Table 3-1 Screening Summary for All Media

Insert 2 of 2

Table 3-1 Screening Summary for All Media

Chapter 4 4 Identification of Removal Action Alternatives

To achieve the RAOs established for the Avery Landing site, a range of potential cleanup options and engineering controls were considered. From these, a specific list of the most feasible removal alternatives were developed and are presented in this section. The following comprehensive removal alternatives have been developed to address site contamination:

Alternative A1 – No Action

Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption (LTTD) of Soils

Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing

Alternative A4 – LNAPL Extraction and Off-Site Disposal

Alternative A5 – Containment and Collection of LNAPL Plume Area

A number of design assumptions must be made to fully develop and evaluate each alternative. These design assumptions are applicable to the technologies proposed in the individual alternatives. However, as additional information is obtained, the assumptions used here may not necessarily be the same as those used as the basis for the final design and specifications. Pre-design field investigations may be needed to provide additional information required to complete the final design.

4.1 Common Components of Alternatives

With the exception of Alternative A1 (No Action), each of the action alternatives listed above has common construction and/or required actions. In this subsection, these common components are identified and described.

4.1.1 Excavation and LNAPL Removal

For those alternatives (A2, A3, and A4) that involve the physical removal of soil containing contaminants above the established cleanup objectives, the following procedures would be implemented.

First, the clean overburden present above the zone of contamination would be excavated, stockpiled on site, and subsequently used for backfill operations upon completion of excavation. To develop the alternatives, it has been assumed that excavation would extend to a depth of approximately 2 feet below the seasonal low groundwater level, or to an average depth of 17 feet bgs. To minimize dewatering, soil below the water table would be removed during periods of low water levels (summer and fall). As discussed in Section 2.4.2, contaminated soil begins at an average depth of 9 feet bgs, and there is an average thickness of 8 feet of LNAPL-contaminated soil. Excavation of the contaminated soils will be initiated in the upgradient portion of the LNAPL plume area and completed in the downgradient portion to prevent recontamination of backfilled soils.

LNAPL encountered with the groundwater in the excavation would be pumped and treated via a large-scale, portable (i.e., trailer mounted) oil/water separator with carbon filter polishing. The oil/water separator would be operated for several weeks to remove free product prior to completion of excavation work. Oil phase contaminants from the separator would be disposed of at an appropriately licensed off-site treatment and/or recycling center. The detailed design will further specify the method for dewatering and disposal of the captured product. Treated groundwater from LNAPL extraction activities would be discharged into the excavation before backfilling with clean and/or treated soil. Oil booms would be used as needed to keep LNAPL from contaminating clean backfill.

Prior to backfilling, confirmation soil samples would be collected to determine compliance with the cleanup objectives or whether additional soil removal would be necessary. Excavated areas would then be backfilled with stockpiled overburden and/or clean backfill and covered with a half-foot of topsoil and seeded once final grading were complete. The detailed design will specify areas for stockpiling, and outline the appropriate sampling frequency and analytes required to determine suitability for backfilling.

For purposes of this EE/CA, it is assumed that:

- The St. Joe River Road would undergo temporary lane closures to allow for excavation of the road and contaminated soils underneath. The road would be reconstructed pursuant to FHA requirements.
- Approximately 90,770 cubic yards of clean overburden soil will be excavated, stockpiled, and reused as backfill.
- Side slopes for excavations would be laid back at 1.5H:1V for stability. As a result of side slope excavation activities, an additional estimated 17,000 cubic yards of clean soil would be excavated, stockpiled, and reused as backfill.
- Soil in the removal area would be excavated down to 2 feet below the seasonal low groundwater table or to an average depth of 17 feet bgs.
- Approximately 47,000 cubic yards of contaminated soil would be excavated and treated. This volume was based on the cross sections of the plume area and the three discrete locations discussed in Section 2.4.2. To yield a conservative estimate, a factor of 10% was added to obtain this volume.
- To further delineate the site topography for earthwork activities, a topographic survey may be conducted as part of the detailed design.

Removal options to address contaminated soil include ex-situ thermal desorption, soil washing, and off-site disposal. These treatment options are presented and developed in Alternatives A2, A3, and A4, respectively. A schematic diagram of the excavation/backfill design common to these three alternatives is shown in Figure 4-1.

4.1.2 Existing Treatment/Recovery System and Debris Removal

As part of all removal alternatives, except for the No Action alternative, the existing geomembrane barrier and collection trench, as well as debris from historical site operations, would be removed and disposed of at an appropriate off-site facility. This would allow for the excavation and treatment of the river bank.

4.1.3 Bank Reconstruction

As part of all removal alternatives, except for the No Action alternative, the shoreline would be excavated to address LNAPL contamination. Disposition of the removed materials would be as follows:

Clean Riprap: Based on field observations, it is assumed that the upper 12 vertical feet of the existing riprap is free of contamination. This clean riprap would be hauled to an on-site area west of the removal area and stockpiled for later reuse.

Contaminated Riprap: The lower 3 vertical feet of the existing riprap is assumed to be contaminated. This material would be hauled to a geomembrane-lined treatment area and steam cleaned and/or pressure washed to remove the contamination. It would then be stockpiled with the clean riprap for later reuse.

Foundations: Based on historical records, it is possible that reinforced concrete foundations from former railroad structures would be encountered during soil removal. These foundations would be broken into manageable-sized pieces. Reinforcing steel, if present, would be removed and salvaged where practicable. The larger concrete fragments would be cleaned, if necessary, and stockpiled with the riprap for future use. Smaller fragments would be used as backfill, if clean, or would be handled as contaminated soil.

Geosynthetics and Wood: Geomembrane and geotextile from previous cleanup activities would be removed and disposed of in a permitted off-site facility. Similarly, the wood dock and other materials that cannot be cleaned would be sent to an off-site disposal facility. For purposes of this EE/CA, it is assumed that the nearest suitable disposal facility is the Waste Management Graham Road Landfill in Medical Lake, Washington, at a road distance of about 125 miles from the site.

Soils with Contamination Below Cleanup Objectives: For alternatives that include treatment, excavated soil would be tested in the field to determine whether it required treatment. Excavated soil not requiring treatment would be stockpiled on site for later use as backfill.

The slope of the new shoreline along the river would be protected from erosion by replacing the 5-foot-thick riprap layer (see Figure 4-1, Stage 4) with cleaned riprap and foundation fragments.

Shoreline reconstruction activities would occur during the seasonal low river elevation period. To facilitate bank reconstruction activities, a spur dike would be constructed upstream of the contaminated shoreline. The spur dike would be comprised of large boulders to reduce the current near the shoreline, therefore minimizing shoreline erosion during construction activities. A silt curtain would be installed downstream of the contaminated shoreline, preventing any contaminated sediments suspended by construction activities from migrating downstream.

4.1.4 Stabilization of Disturbed Areas

At the conclusion of any of removal alternatives A2 through A5, any disturbed area would be stabilized to prevent erosion. Backfilled areas will be graded and re-vegetated.

4.1.5 Best Management Practices

All construction activities associated with removal alternatives A2 through A5 will address federal and Idaho storm water best management practices. Specific best management practices for storm water management and fugitive dust control will be detailed in the final design. Pending removal from the site, stockpiled soils from the excavation will be covered with plastic sheeting to mitigate dust generation and potential runoff from precipitation.

4.1.6 Institutional Controls and Monitored Natural Attenuation for Sediment and Surface water

Sediment and surface water contamination would be addressed by monitored natural attenuation. Based on field investigation results, it is assumed that contaminated sediment exists 6 feet from the shoreline along the length of the LNAPL plume. It is uncertain how badly the habitat within the contaminated sediment area has been affected, but if dredging were performed, the entire habitat would be destroyed. Assuming the source of the contamination is eliminated or contained, natural processes will eventually reduce contaminant concentrations to below the cleanup levels.

Natural attenuation makes use of natural biodegradation processes to reduce the concentration and amount of pollutants at contaminated sites and is often used as a part of a site cleanup that also includes control or removal of the source of contamination.

Monitored natural attenuation is recognized by EPA as an effective and cost-effective cleanup alternative for certain types of contaminated sites, particularly for petroleum release sites (EPA 1999). Natural attenuation is sometimes mislabeled as a “no action” approach. However, natural attenuation is actually a proactive approach that focuses on the confirmation and monitoring of natural mass-removal processes rather than relying totally on engineered technologies. Natural attenuation is non-invasive and less costly than engineered treatment options, and requires no energy source or special equipment.

In accordance with the Uniform Environmental Covenants Act (UECA), institutional controls would also be implemented at the Avery Landing site. The main purposes for establishing institutional controls are: (1) to limit or prohibit exposure of people and the environment to contaminants remaining at the site after removal actions are complete; (2) to prevent or limit activities in certain areas of the site that may increase the risk of damage to the integrity, or reduce the effectiveness, of the selected remedy and other engineering control systems; and (3) to limit the land use and development of the site to certain activities (i.e., commercial or industrial use). Signage along the river bank warning of contaminated sediments would be an example of institutional controls implemented at the site.

4.1.7 Post-Removal Monitored Natural Attenuation for Groundwater

Residual groundwater contamination would be addressed by monitored natural attenuation once the LNAPL contamination in the source area is excavated and treated. The detailed design and subsequent development of the post-removal site care plan will identify the necessary analytical parameters, sampling frequency and reporting requirements.

4.1.8 Post-Removal Action Monitoring

Post removal action monitoring would consist of semiannual groundwater, soil, sediment, and surface water sampling. These sampling events would occur at periods of high and low river elevations. Post removal action monitoring would apply to all removal alternatives except for the No Action alternative. For purposes of this EE/CA, it is assumed that post removal action monitoring activities would last for 5 years for the soil excavation and treatment/disposal alternatives (A2, A3, and A5). For Alternative A5, containment and collection of the LNAPL plume area, a longer period of post-removal action monitoring would be required. Additional requirements for post-removal monitoring would be determined during the final design phase in accordance with the UECA.

4.2 Identification of Removal Action Alternatives

4.2.1 Alternative A1: No Action

Under this alternative, no action would be taken to remove, treat, or contain contaminated soils, groundwater, sediment, or surface water at the Avery Landing site. Because contaminated media would remain in place, the potential for continued migration of contaminants would not be mitigated. This alternative will not address the continued release of product to the St. Joe River. However, as with monitored natural attenuation, contaminants in site media would be expected to gradually reduce through natural degradation processes, albeit more slowly than if the contaminant source (i.e., the LNAPL plume area) were removed.

The site-wide No Action alternative has been included as a requirement of the NCP and to provide a basis of comparison for the remaining alternatives.

4.2.2 Alternative A2: LNAPL Extraction and Ex Situ Thermal Desorption of Soils

In this alternative, soil having contaminant concentrations that exceed the cleanup levels would be excavated and transported to a soil stockpile area located on site, followed by desorption of the contaminants from the soil matrix using a mobile low-temperature thermal desorption (LTTD) unit.

LTTD involves heating contaminated soils in a chamber using either electricity, propane, or natural gas, thereby volatilizing the moisture and organic contaminants. LTTD desorbs organic compounds without heating the soil to combustion temperatures. Given the relatively low temperature range associated with treatment (300 to 500 °F), inorganic compounds are not volatilized. Desorbed organics from the thermal processor are drawn into a fabric filter. An air-cooled condenser may be used to remove most of the water vapor and organics. Activated carbon, caustic scrubbers, and afterburners may need to be employed as an air pollution control system to treat exhaust gases. The thermally treated soil is then moved into a conditioner, where it is sprayed with water to cool it and minimize fugitive dust emissions. After cooling, the treated soil is stockpiled for analysis and reused as backfill. A schematic diagram of the LTTD process is shown in Figure 4-2. The feed rate, desorption temperature, and residence time of the materials in the chamber dictate the type of contaminants removed, as well as the degree to which the contaminants are removed.

With LTTD treatment, there is a potential for some contaminants with volatilization temperatures above the LTTD operating temperatures to remain in the soil/waste mixture. PCB contaminants would not be treated with LTTD treatment. However, PCB soil concentrations are below screening levels. Following treatment, the treated soil would be tested for the analytical parameters of concern, and assuming that the soil meets soil cleanup standards, the treated soil would be re-used on site. Soil not meeting cleanup objectives would be disposed of at an off-site non-hazardous waste disposal facility that accepts PCB-contaminated soil. The LTTD system is designed to treat organic contaminants with boiling points less than 500 °F, and soil with less than 15% moisture content. Moisture content can be lowered in the waste feed preparation process if necessary. Most thermal units readily treat coarse-grained soils, but require longer processing times and consequently lower throughput rates for materials with high silt and clay contents.

LTTD units are either fixed or mobile, depending on their size and operating requirements. A mobile unit would be used at the Avery Landing site. Thermally treated soil that meets cleanup levels would be used to backfill the excavation. For cost estimating purposes, it was assumed that 10% of the soil would require retreatment using LTTD to meet cleanup levels. It was also assumed that 10% of the contaminated soil would be untreatable and sent offsite for disposal.

Excavated areas would be backfilled with clean gravel prior to soil backfill. Gravel would be placed below the groundwater surface and soil would be placed above the gravel to allow for proper soil compaction. Soils not meeting cleanup levels after treatment would be sent off site for disposal. Gravel and any additional backfill soil needed would be obtained from a nearby commercial gravel and soil yard.

During treatment activities, air monitoring would be conducted pursuant to Occupational Safety and Health Administration (OSHA) and National Emission Standard for Hazardous Air Pollutants (NESHAP) regulations to ensure that workers and the public are not exposed to site contamination above allowable levels. Air emission standards and potentially required air pollution control equipment could become a substantial cost and performance factor for on-site LTTD.

Based on the soil volumes requiring treatment, and an overall average feed rate of 20 tons per hour, it is estimated that this alternative would require approximately 6.5 months from the time of mobilization to the time of demobilization.

The LTTD cost estimate assumes that a total of 350 confirmation samples would be collected and analyzed for COCs during the anticipated 5-month treatment time. In addition, air samples would be collected monthly from one upwind and two downwind monitoring points to determine emission concentrations of COCs from the LTTD unit operation.

4.2.3 Alternative A3: LNAPL Extraction and Ex-situ Soil Washing

In this alternative, excavated soil not meeting cleanup criteria would be treated using soil washing. Soil washing is an ex-situ treatment that consists of a combination of size separation and water washing to remove hydrocarbons from contaminated soil. Surfactants would be used in conjunction with water to enhance contaminant removal. Backfill material would consist of both the treated soils meeting cleanup criteria and the clean soil overburden that was stockpiled during the process of accessing the contaminated material. Excavated areas would be backfilled with clean gravel prior to soil placement. Gravel would be placed to fill the excavation to just above the groundwater surface. Treated and/or clean soil would be placed above the gravel and then compacted. Soils not meeting cleanup levels after treatment would be sent off site for disposal. Gravel and any additional backfill soil needed would be obtained from a nearby commercial gravel and soil yard.

A process flow diagram for soil washing is shown in Figure 4-3. The treatment process is further described in the treatability study report written by ART Engineering (ART 2009; Appendix F). The treatment effectiveness, based on the site-specific treatability study, is also presented in the ART report. Based on the treatability study results, it is anticipated that water with surfactant would be used. If soil washing is selected, an additional pre-design study may be necessary to optimize the treatment process.

In the soil washing treatability study, wash water was successfully treated to remove soil fines and dispersed hydrocarbon. This would allow for the full-scale plant to be designed as a closed-loop system in which the water was continuously treated and reused. Upon completion of soil washing, any residual wash water would be treated and discharged by spreading on the treated soils.

According to the ART Engineering treatability study report, soil washing would produce residual filter cake (approximately 8% of treated soil volume) that would require further treatment or off-site disposal.

Based on the soil volumes requiring treatment, and an overall estimated average production rate of 50 to 60 tons per hour (ART 2009, Appendix F), it is estimated that this alternative would require approximately 3.5 months to from the time of mobilization to the time of demobilization.

4.2.4 Alternative A4: LNAPL Extraction and Off-Site Disposal

Under this alternative, contaminated soil not meeting cleanup criteria would be excavated, loaded into haul trucks, and transported to a CERCLA-approved off-site non-hazardous waste disposal facility. It has been confirmed that the disposal facility accepts soils with oil contents greater than 3%. Approximately 32,000 cubic yards of oily soil (with no PCBs) would be hauled to the Graham Road Landfill in Medical Lake, Washington.

PCB-contaminated soil would be excavated and segregated from the non-PCB contaminated soil, loaded into haul trucks, and transported to an off-site non-hazardous waste disposal facility that accepts PCB-contaminated soil. For purposes of this EE/CA, it is assumed that the nearest suitable disposal facility for PCB-contaminated soil is the Waste Management Wenatchee Landfill in Wenatchee, Washington, at a road distance of about 280 miles from the site. Approximately 15,600 cubic yards of PCB contaminated soil would be excavated and disposed of at this landfill. This volume was determined by analyzing data for PCB contamination and delineating PCB areas where PCB contamination was encountered. For purposes of this EE/CA, the depth of PCB contamination in these areas was assumed to be the site-wide average excavation depth of 17 feet. In order to further delineate the volume of PCB contaminated soil, a sub-surface soil investigation may be conducted prior to the final design.

Excavated areas would be backfilled with clean gravel and soil obtained from a nearby commercial gravel yard. Gravel would be placed below the groundwater surface and soil would be placed above the gravel to allow for proper soil compaction.

Excavation is an effective method for physically removing contaminated subsurface material from the site. Excavation involves the use of standard construction equipment. There are few limitations on the types of waste that can be excavated and removed.

Based on the estimated volume of soil that exceeds cleanup criteria, it is estimated that this alternative would require approximately 3.5 months from the time of mobilization to the time of demobilization.

4.2.5 Alternative A5: Containment and Collection of LNAPL Plume Area

For this alternative, the existing LNAPL containment and recovery system would be replaced by a new LNAPL containment and recovery system. The new system would consist of an impermeable barrier and continuous collection trench. For cost estimating purposes, it was assumed that the impermeable barrier would be implemented as a slurry wall, with an adjacent gravel collection trench. It is anticipated that, with this alternative, LNAPL removal would require at least 30 years.

The collection trench would be filled with gravel and would extend the length of the entire LNAPL plume and to a depth of at least 5 feet below the seasonal low water level to ensure that free product would not travel below the barrier. For cost estimating purposes, it was assumed that the slurry wall and gravel collection trench would extend to a depth of 25 feet bgs. Free product would be removed from the gravel collection trench by belt-operated skimming pumps housed in vertical risers extending into the recovery trench. The LNAPL would be pumped into a liquid storage container for subsequent off-site disposal.

Positive containment at the downstream end of the wall would be ensured by constructing a cutoff wall that would extend back into the property for a total distance of approximately 50 feet. The layout of this trench/barrier system alternative is shown in Figures 4-4 (plan view) and 4-5 (cross section).

The area adjacent to the shoreline where soil has been removed for bank reconstruction would be partially backfilled with clean soil to form a bench for installing the barrier/collector trench. The source of backfill soil would be clean soil with contaminant concentrations less than the cleanup levels. The elevation of the upper surface of the backfill would be above the design-basis high water stage of the St. Joe River. This elevation would be determined during the detailed design process, but for purposes of this EE/CA, is assumed to be 10 feet above the seasonal low water stage. A clean soil cover would also be used to cover surface soils having contaminant concentrations greater than the cleanup levels and to minimize exposure. For this alternative, further pre-design field investigations would be necessary to better define the full extent of the LNAPL plume.

Insert 1 of 1

Table 4-1 Removal Action Alternatives

Insert 1 of 1

Table 4-2 Common Components of Alternatives

This page intentionally left blank.

Insert 1 page, 11x17

Figure 4-1, Excavation and Backfill of Contaminated Soil, Stages 1–4

Figure 4-1, Page 2 (11x17)

Insert 1 of 1

Figure 4-2 Process Flow Diagram for Full-Scale Soil Washing

Insert 1 of 1

Figure 4-3 Process Schematic for Full-Scale Low-Temperature Thermal Desorption

Insert 1 of 1

Figure 4-4 Containment and Collection of LNAPL Plume Area, Plan View

Insert 1 of 1

Figure 4-5 Containment and Collection of LNAPL Plume Area, Cross Section

Chapter 5 5 Individual Analysis of Removal Action Alternatives

This section presents an individual analysis of the alternatives based on the short- and long-term aspects of three broad criteria: effectiveness, implementability, and cost. These criteria are described below.

Effectiveness
Effectiveness includes several evaluation factors, which are defined below.

Overall Protection of Human Health and the Environment: Assesses the ability of the alternative to be protective of human health and the environment under present and future land use conditions.

Compliance with ARARs: Identifies whether or not implementation of the alternative would comply with all chemical-specific, action-specific, and location-specific ARARs and TBC requirements.

Long-term Effectiveness: Addresses the magnitude of residual risk remaining at the conclusion of removal activities; that is, addresses the adequacy and reliability of controls established by a removal action alternative to maintain reliable protection of human health and the environment over time.

Reduction of Toxicity, Mobility, and Volume through Treatment: Identifies whether or not implementation of the alternative would reduce contaminant toxicity (e.g., reduction of LNAPL contamination), mobility (e.g., preventing contaminated soil from reaching human receptors), or actual volume of the hazardous substances.

Short-term Effectiveness: This criterion addresses the effects of an alternative during the construction and implementation phase until the removal objectives are met. This criterion includes the time with which the remedy achieves protectiveness and potential to create adverse impacts on human health and the environment during construction and implementation.

Implementability
Implementability is evaluated in accordance with the criteria defined below.

Technical Feasibility: Evaluates construction and operational considerations, as well as demonstrated performance/useful life.

Administrative Feasibility: Evaluates activities such as statutory limits, permitting requirements, easements/rights of ways, and impact on adjoining property.

Availability of Service and Materials: Considers the availability of qualified contractors to handle site preparation, design, equipment, personnel, services and materials, excavation, disposal capacity, and transportation in time to maintain the removal schedule, as well as the availability of disposal facilities that are licensed to accept hazardous and non-hazardous liquid/solid waste.

State Acceptance: Considers whether IDEQ is likely to concur with the proposed alternatives.

Community Acceptance: Considers level of stakeholder acceptance of the proposed alternatives.

Cost

Summaries of the alternative costs (except for the No Action alternative) are provided in Tables 5-1 through 5-4, and assumptions and references for the cost estimates are included in Appendix G. Each removal action alternative was evaluated to determine its project cost. The cost estimates contain the capital cost and annual operational and maintenance costs. The cost estimate for each component of the proposed alternatives is based on assumptions provided in this section and in Appendix G.

Costs are based in part on the estimated LNAPL plume area and the estimated 47,000 cubic yards of contaminated soil. Because of uncertainties about the exact amount of contaminated material and other uncertainties, actual cleanup costs may be expected to range by an approximate factor of ±20%.

The present worth is calculated for alternatives that will last longer than 12 months (EPA 1993b), Under this EE/CA, removal action alternatives A2, A3, and A4 will require 6.5 months or less of operation; therefore, present worth is not required for those alternatives. The present worth was calculated for removal action alternative A5, due to the long O&M period associated with it.

5.1 Alternative A1: No Action

The No Action alternative was evaluated to provide a baseline to which other alternatives can be compared, as required by the NCP. Under this alternative, contaminated soils, groundwater, sediment, and surface water would be left in their present condition.

Effectiveness

Protection of human health and the environment is not provided by Alternative A1. Contaminant concentrations and existing and future risks to human health and the environment would remain unchanged. Since media containing COCs that exceed the cleanup levels would be left on site without any protective barriers or controls, the RAOs established for the Avery Landing site would not be achieved. The No Action alternative offers no long-term effectiveness or permanence. Additionally, this alternative provides no reduction in toxicity, mobility, or volume of contaminants.

Overall Protection of Human Health and the Environment: Under this alternative, no removal actions will be implemented to control potential exposure pathways or to reduce contaminant concentrations in soil. As a result, there will be no measurable reduction in potential human health or environmental risks.

Compliance with ARARs: Under this removal action alternative, no active effort will be made to reduce contaminant levels below chemical-specific ARARs or TBC criteria. Over an indefinite period of time, passive remediation, in the form of dispersion and dilution, may reduce contaminant levels to below TBC criteria. No action-specific or location specific ARARs apply to the No Action alternative.

Long-Term Effectiveness and Permanence: Under the No Action alternative, contaminants in the soil will result in unacceptable health risks for the current or future industrial worker and/or occasional recreational visitors.

Under the No Action alternative, any long-term or permanent effect on contaminant levels will depend on the effectiveness of natural attenuation. The extent to which natural attenuation may reduce contaminant levels and the time it will take cannot be predicted, given that no monitoring will be performed.

Reduction of Toxicity, Mobility, or Volume through Treatment: The No Action alternative does not provide physical treatment processes for toxicity, mobility, or volume reduction of contaminated soil. Although passive treatment processes (i.e., natural attenuation, physical dispersion) may eventually provide limited toxicity and volume reduction of the contaminated soil, the extent to which these processes may reduce contaminant toxicity and volume cannot be predicted, due to the lack of data.

Short-Term Effectiveness: As there are not any active physical removal action activities associated with the No Action alternative, there are no increased short-term potential risks to workers or the community. Also, there will be no additional short-term environmental impacts.

Implementability

This alternative is readily implementable since there are no technologies that have to be implemented, administrative coordination is not required, and there are no labor, equipment, material, or laboratory services to be obtained.

Cost

There are no costs associated with this alternative.

5.2 Alternative A2: LNAPL Extraction and Ex Situ Thermal Desorption of Soils

This alternative involves the excavation of soil containing contaminants above cleanup levels, followed by ex-situ thermal desorption treatment for soil. LNAPL encountered on the surface of the groundwater during excavation activities will be pumped and treated by an oil/water separator and carbon polishing unit. The cleanup objectives will be protective for industrial, commercial, and/or occasional use by a recreational visitor.

Effectiveness

Alternative A2 will be an effective and permanent removal action. The contaminated soil will be excavated and treated by LTTD. Excavated areas will then be backfilled with treated soils. LNAPL encountered during excavation activities will be pumped and treated using an oil/water separator and carbon polishing, preventing recontamination of backfilled soils. Residuals and/or PCB containing materials from the treatment process will be disposed off site at an appropriate facility.

Overall Protection of Human Health and the Environment: Because this alternative involves excavation and LTTD treatment of contaminated soil, the alternative will reduce potential risks to human health and the environment. Exposure pathways are eliminated with the site-wide excavation and LTTD treatment of contaminants that exceed cleanup levels. However, the LTTD treatment process poses potential risks to workers and the community due to air releases during excavation and treatment. Air monitoring would be required.

Compliance with ARARs: In this alternative, contaminated soil that exceeds cleanup levels is treated using LTTD. Vendors understand the limitations of their process equipment and the need for pollution control of the off-gas. By stating the air discharge requirements in the removal design, the technology would be incorporated upfront, thereby meeting the air ARARs. The removal design also would incorporate measures to minimize dust generation, thereby meeting the dust suppression ARAR. Activities at the site would be implemented such that all ARAR and TBC requirements would be met.

Long-Term Effectiveness and Permanence: Excavation and subsequent soil treatment via LTTD provides an effective and permanent treatment. The contaminated soil would be excavated and treated by LTTD, and LNAPL would be treated using an oil/water separator and carbon polishing. LTTD has been proven effective in reducing COC concentrations to less than or equal to typical risk-based concentrations. The potential for contact with receptors would be eliminated, thus eliminating the potential risks of exposure. This alternative would be effective in the long term because the contaminants would be permanently removed from the site, and would substantially minimize the potential risk to human health or the environment.

Reduction of Toxicity, Mobility, or Volume: Toxicity, mobility, and volume of contaminants would be reduced through LTTD treatment. Heating the soils and volatizing the contaminants would reduce the toxicity of the soil itself, since the contaminants would be removed. However, in their volatilized state, contaminants would have greater mobility. Emission controls associated with the treatment process should help to contain and collect the contaminants. Given that the contaminants would have been "removed" from the soil and subsequently condensed in a liquid matrix, there would be a reduction in the overall volume of contaminants.

Short-Term Effectiveness: In the short- term, there is a potential for construction workers to be exposed to contaminated soil during excavation and vapors during LTTD treatment activities. Exposures to human health and the environment can be minimized by the proper use of personal protective equipment and by implementation of erosion and sediment control measures, and dust controls during operations.

Implementability

The use of LTTD is widespread, and the technology is mature. Excavation activities associated with this alternative are labor-intensive practices with little potential for further automation. Commonly used earth-moving equipment and site work procedures would be employed to excavate and transport contaminated soil and to place, contour, and seed the clean backfill and topsoil. Although the site is in a remote area, transportation of equipment and fuel supplies would be made possible by St. Joe River Road, which is adjacent to the site. The time required to implement this alternative may be relatively long and substantive planning and design requirements must be addressed. Also, the public may oppose the use of LTTD technology because they may view it as being similar to incineration.

Cost
The estimated cost is $9,710,000 (Table 5-1).

5.3 Alternative A3: LNAPL Extraction and Ex Situ Soil Washing

This alternative involves the ex situ soil washing treatment of soil containing contaminants above cleanup levels. The cleanup objectives will be protective for industrial, commercial, and/or occasional use by a recreational visitor.

Effectiveness
The ex situ soil washing and LNAPL extraction alternative would be an effective and permanent removal action. The contaminated soil would be excavated and treated by soil washing using a surfactant. Excavated areas would then be backfilled with treated soils that meet cleanup objectives, and the areas would be seeded. LNAPL encountered during excavation activities would be pumped and treated using an oil/water separator and carbon polishing, preventing recontamination of backfilled soils. Residuals and/or PCB-containing materials from the treatment process would be disposed off site at an appropriately licensed disposal facility.

Overall Protection of Human Health and the Environment: Because this alternative involves excavation and the subsequent removal of COCs from the contaminated soil, the alternative would reduce potential risks to human health and the environment.

Compliance with ARARs/TBC criteria: In this alternative, contaminated soil that exceeds cleanup levels would be treated by soil washing. Activities at the site would be implemented such that all ARAR and TBC requirements would be met.

Long-Term Effectiveness and Permanence: Excavation and subsequent soil treatment via soil washing would provide long-term effectiveness and permanence. LNAPL would be removed using an oil/water separator and carbon polishing. Contact of contaminants with receptors would be eliminated, thus eliminating the potential risks of exposure. This alternative would be effective in the long term, because the contaminants would be permanently removed from the site, and the potential risk to human health or the environment would be substantially minimized.

Reduction of Toxicity, Mobility, or Volume: The volume of contaminants would be reduced through soil washing treatment. The soil washing treatability study results (Appendix F; ART 2009) indicated that significant hydrocarbon removal can be achieved for washed gravel and sand fractions, which were 95% of the soil mass on a dry weight basis. The hydrocarbons removed in the soil washing process would be concentrated and pressed into a fines filter cake for off-site disposal. Given that the contaminants would have been removed from the soil and subsequently condensed in a solid matrix, there would be a reduction in the overall volume.

Short-Term Effectiveness: In the short term, construction workers might be exposed to disturbed contaminated soil during excavation and LNAPL during pumping and treatment. Exposures to human health and the environment would be minimized by the proper use of personal protective equipment and by implementation of erosion and sediment control measures and dust controls during operations.

Implementability

Soil washing technology is well understood and would be easily implemented at the site. Excavation activities associated with this alternative are labor-intensive practices with little potential for further automation. Commonly used earth-moving equipment and site work procedures would be employed to excavate and transport contaminated soil and to place, contour, and seed the clean backfill and topsoil. The time required to implement this alternative might be relatively long and substantive planning and design requirements would need to be addressed.

Cost

The estimated cost is $6,620,000 (Table 5-2).

5.4 Alternative A4: LNAPL Extraction and Off-Site Disposal

This alternative involves the excavation and disposal of soil containing contaminants above the concentrations stated in the cleanup objectives. The cleanup objectives would be protective for industrial, commercial, and/or occasional use by a recreational visitor.

Effectiveness

The excavation and disposal alternative would be an effective and permanent removal action. The contaminated soil would be removed from the site and placed at an off-site disposal facility where contact with potential site receptors would be eliminated. LNAPL encountered during excavation activities would be pumped and treated using an oil/water separator and carbon polishing, preventing recontamination of backfilled soils.

Overall Protection of Human Health and the Environment: Because this alternative would involve excavation and off-site disposal of contaminated soil and removal of LNAPL, the alternative would reduce potential risks to human health and the environment. Exposure pathways would be eliminated with the site-wide excavation of contaminants that exceed cleanup levels.

Compliance with ARARs/TBC criteria: In this alternative, contaminated soil that exceeds cleanup levels would be removed from the site. Activities at the site would be implemented such that all ARAR and TBC requirements would be met.

Long-Term Effectiveness and Permanence: The excavation and disposal alternative provides effectiveness and permanence. The contaminated soil would be excavated and removed from the site and placed at an off-site disposal facility, and LNAPL would be treated using an oil/water separator and carbon polishing. Contact of contaminants with receptors would be eliminated, thus eliminating the potential risks of exposure. This alternative would be effective in the long term, because the contaminants would be permanently removed from the Avery Landing site, and the alternative would substantially minimize the potential risk to human health or the environment.

Reduction of Toxicity, Mobility, or Volume: Neither toxicity nor volume of contaminants would be reduced through treatment under the excavation and disposal alternative because no treatment technologies would be used. However, the physical removal of the soil would eliminate exposure of contaminants to site receptors. Similarly, mobility of contaminants that exceed cleanup levels at the site would be reduced, because they would be disposed of in a secured and approved landfill. The volume of the contaminated soil would not be reduced. The disposal facility would enclose the contaminated soil in a monitored environment that would be more secure than the current site.

Short-Term Effectiveness: In the short term, construction workers may be exposed to disturbed contaminated soil during excavation. Exposure of humans and the environment would be minimized by the proper use of personal protective equipment and by implementation of erosion and sediment control measures and dust controls during operations. However, since the removal of the soil pile would require transportation off site (by truck), there may be a short-term increase in risks to exposure via spills or an accident.

Implementability

This alternative is readily implementable because no active treatment technologies would be used. Excavation and off-site disposal is a relatively simple process, with proven procedures and demonstrated performance. This technology has been widely used for disposal of contaminated soil and is a labor-intensive practice with little potential for further automation. Commonly used earth-moving equipment and site work procedures would be employed to excavate and transport contaminated soil and to place, contour, and seed the clean backfill and topsoil.

Cost

There are no capital or O&M costs associated with this alternative. The estimated cost is $7,500,000 (Table 5-3).

5.5 Alternative 5: Containment and Collection of LNAPL Plume Area

This alternative would consist of an impermeable barrier installed along the bank of the St. Joe River and continuous collection trench. Vertical risers in the collection trench would allow access to accumulated LNAPL for removal.

Effectiveness

The LNAPL containment and collection alternative is a long-term approach to LNAPL containment and removal. This approach would mitigate the mobile phase of the LNAPL plume, but would not treat the non-mobile phase and/or contaminated soil. Also, it would not treat the dissolved-phase contaminant plume.

Overall Protection of Human Health and the Environment: In this alternative, protection to human health and the environment would be provided primarily by containment. Containment would be provided by a slurry wall preventing the seep of LNAPL into the St. Joe River and by a clean soil cover to minimize direct contact at the surface. Future excavations at the site could result in exposure to site contaminants.

Compliance with ARARs/TBC criteria: In this alternative, LNAPL would be contained and the mobile phase of the LNAPL plume would slowly be removed. This alternative may not achieve chemical-specific ARARs and TBCs for individual hazardous substances. Activities at the site would be implemented such that over ARAR and TBC requirements would be met.

Long-Term Effectiveness and Permanence: This removal alternative would contain the LNAPL plume as soon as it was fully implemented; however, it would require several years to remove the mobile LNAPL plume. Free product sorbed to subsurface soils would remain at the site, and potential dissolved phase contamination would not be treated. If contaminants were allowed to attenuate naturally, their removal to less than cleanup levels might not be possible. This alternative offers limited long-term effectiveness and no permanence.

Reduction of Toxicity, Mobility, or Volume: In this alternative, physical containment and removal of LNAPL would prevent the LNAPL from seeping into the St. Joe River, therefore eliminating the possibility that receptors could be exposed to contaminants. Although the toxicity and volume of LNAPL would not be reduced, the LNAPL would be removed from the site to a disposal facility. Therefore, the volume, mobility, and toxicity of contaminants at the site would be reduced.

Short-Term Effectiveness: In the short term, construction workers may be exposed to disturbed contaminated soil during trench and barrier excavation activities. Exposure to human health and the environment would be minimized by the proper use of personal protective equipment and by implementation of erosion and sediment control measures and dust controls during operations.

<u>Implementability</u>
This alternative is readily implementable because no active treatment technologies would be used. Excavation for the collection trench impermeable barrier is a relatively simple process, with proven procedures and demonstrated performance. This technology has been widely used for LNAPL plume capture and is a labor-intensive practice with little potential for further automation. Commonly used earth-moving equipment and site work procedures would be employed to excavate and construct the collection trench and impermeable barrier.

<u>Cost</u>
The estimated cost is $4,410,000 (Table 5-4).

Insert 1 of 1

Table 5-1 Removal Action Cost Analysis for Alternative A2, Ex Situ Thermal Desorption of Soils and LNAPL Extraction

Insert 1 of 1

Table 5-2 Removal Action Cost Analysis for Alternative A3, Ex Situ Soil Washing and LNAPL Extraction

Insert 1 of 1

Table 5-3 Removal Action Cost Analysis, Alternative A4, Off-Site Disposal LNAPL Extraction

Insert 1 of 1

Table 5-4 Removal Action Cost Analysis, Alternative A5, Containment and Collection of LNAPL Plume Area

Chapter 6 6 Comparative Analysis of Removal Action Alternatives

In Section 5, each removal alternative was analyzed independently, without consideration of other alternatives. In this section, the alternatives are compared, considering effectiveness, implementability, and cost. This comparative analysis identifies the advantages and disadvantages of each alternative relative to the others.

Alternative A1, the No Action alternative, will not be considered for this comparative analysis due its lack of effectiveness. The remaining alternatives are:

Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption (LTTD) of Soils

Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing

Alternative A4 – LNAPL Extraction and Off-Site Disposal

Alternative A5 – Containment and Collection of LNAPL Plume Area

6.1 Effectiveness

A summary of the effectiveness comparison is provided in Table 6-1.

6.1.1 Overall Protection of Human Health

The removal action alternatives evaluated for this EE/CA are protective of human health and the environment. The least protective would be Alternative A5 (containment and collection), because the impermeable barrier and collection trench would only capture the LNAPL that exists on the surface of the groundwater. Although it would prevent LNAPL from seeping into the St. Joe River, contaminants would remain sorbed to subsurface soils and dissolved phase contaminants would not be treated. Alternative A4 (off-site disposal), while protective of human health for the surrounding residents, would not reduce the concentrations of COCs present in the soils and wastes. Rather, the soils and wastes would only be moved to another locale, which makes it more protective of Alternative A5, but not as protective as Alternatives A3 and A2. Alternatives A2 and A3 are the most protective of human health. While using different technologies, they both remove the contamination from site soil and groundwater. However, Alternative A3 (soil washing) is slightly more protective of human health than Alternative A2 (LTTD), because it is easier to contain and handle the contaminants in a liquid form, while A2 vaporizes the contamination in order to remove it from the soil matrix.

On this basis, the alternatives are ranked as follows for overall protection of human health (most to least effective):

1. Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing
2. Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption of Soils
3. Alternative A4 – LNAPL Extraction and Off-Site Disposal

4. Alternative A5 – Containment and Collection of LNAPL Plume Area

6.1.2 Compliance with ARARs/TBC Criteria
All four removal alternatives evaluated for this EE/CA could be implemented to meet the chemical-specific, action-specific, and location-specific ARAR and TBC criteria outlined in Section 2, although Alternative A 3 (containment and collection), may not meet some ARARs and TBCs for specific hazardous constituents.

6.1.3 Long-Term Effectiveness and Permanence
Alternative A5 (containment and collection) would have the least long-term effectiveness because the contaminant plume would remain until all LNAPL was captured and extracted. Additionally, there is the potential for a considerable amount of LNAPL to remain adsorbed to the soil matrix, increasing the time to achieve permanence. Also, Alternative A5 would be less reliable than Alternatives A2, A3, and A4 because a breach in the barrier could occur, allowing LNAPL to seep into the St. Joe River.

Of the three remaining alternatives, Alternative A2 (LTTD) provides the most effective and permanent solution. By heating and volatilizing the contaminants, the soil cleanup objectives will be met. Alternative A3 (soil washing) is more effective than Alternative A4 (off-site disposal) in that most of the contamination can be "washed out" of the soil, although some of the soil will still require disposal at a secured facility. Because of the greater off-site disposal requirements for soil washing, Alternative A3 does not provide as much permanence as Alternative A2.

Based on a side-by-side comparison, the alternatives are ranked as follows for long-term effectiveness (most to least effective):

1. Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption of Soils
2. Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing
3. Alternative A4 – LNAPL Extraction and Off-Site Disposal
4. Alternative A5 – Containment and Collection of LNAPL Plume Area

6.1.4 Reduction of Toxicity, Mobility, or Volume
Alternative A2 (LTTD) provides the greatest reduction in toxicity, mobility, and volume of contamination. LTTD will volatize and strip the contaminants from the soil matrix. Provided that the collection system is operated properly, the volume of contaminated media requiring disposal will be kept to a minimum. Alternative A3 (soil washing) provides a greater reduction in the three criteria than the remaining two alternatives. Soil washing will generate a waste stream that is greater than A2; however, since the majority of the soil will be meet the cleanup objectives and can be used as backfill, it provides a greater reduction in toxicity, mobility, and volume than Alternative A4 (off-site disposal), which reduces only the mobility of the contaminated soil by moving it to a disposal facility that simply prevents contaminant migration.

While Alternative A5 (containment and collection) would contain the LNAPL plume and prevent it from seeping into the St. Joe River and the clean soil cover would prevent direct exposure to human receptors, it does not provide a reduction in toxicity, and only a limited reduction in mobility and volume. Therefore, Alternative A5 provides the least reduction of toxicity, mobility, and volume.

On this basis, the alternatives are ranked as follows for reduction of toxicity, mobility, or volume criteria (most to least reduction):

1. Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption of Soils
2. Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing
3. Alternative A4 – LNAPL Extraction and Off-Site Disposal
4. Alternative A5 – Containment and Collection of LNAPL Plume Area

6.1.5 Short-Term Effectiveness

Alternative A5 (containment and collection) ranks highest for short-term effectiveness because the amount of construction required is relatively small compared with Alternatives A2, A3, and A4. Of the remaining alternatives, Alternative A4 (off-site disposal) provides the most short-term effectiveness. While the three remaining alternatives require excavating contaminated media, Alternative A4 only requires that clean backfill material be brought on-site and that contaminated media is hauled off-site for disposal.

Of the remaining two alternatives, Alternative A2 (LTTD) provides the least amount of short term effectiveness in that LTTD would involve more planning and operational issues to implement.

The alternatives are ranked as follows for short-term effectiveness (most to least effective):

1. Alternative A5 – Containment and Collection of LNAPL Plume Area
2. Alternative A4 – LNAPL Extraction and Off-Site Disposal
3. Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing
4. Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption of Soils

6.2 Implementability

A summary of the implementability comparison is provided in Table 6-2.

6.2.1 Technical Feasibility

For the removal action alternatives, technical feasibility decreases as the complexity of the treatment technology increases. Therefore, Alternative A5 (collection and containment) is the most technically feasible alternative when compared to the remaining three alternatives that require extensive soil excavation and complex dewatering and LNAPL collection.

Given that Alternative 4 (off-site disposal) requires the same amount of soil excavation and LNAPL collection as the remaining two alternatives, it differs in that hauling clean soil on-site and contaminated soil to a disposal facility is all that remains for this alternative. Excavation and off-site disposal is a well-established technology for addressing contaminated sites, which makes Alternative A4 more technically feasible than Alternatives A2 and A3, which require complex treatment technologies.

Since the technology and system operations are straightforward, Alternative A2 (LTTD) is technically more feasible than Alternative A3 (soil washing). Provided there is a sufficient energy source to operate the LTTD kiln, thermally heating the soil to volatize the contaminants is a straightforward process that can successfully achieve the cleanup objectives. The development of the appropriate soil wash mixture (e.g., selecting the right surfactant) for Alternative A3 (soil washing) can be imprecise. While laboratory treatability studies can show that the technology is applicable for a site, it does not guarantee success during a full-scale operation. Because of this uncertainty, Alternative A2 is more technically feasible than Alternative A3.

On this basis, the alternatives are ranked as follows for the technical feasibility criteria (most to least feasible):

1. Alternative A5 – Containment and Collection of LNAPL Plume Area
2. Alternative A4 – LNAPL Extraction and Off-Site Disposal
3. Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption of Soils
4. Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing

6.2.2 Administrative Feasibility

Alternatives A2, A3, and A4 would involve re-routing traffic on St. Joe River Road using temporary lane closures. This requirement alone would involve more planning and logistical requirements than would Alternative A5 (containment and collection). Therefore, Alternative A5 is most administratively feasible

While permits are not needed for a CERCLA removal action, it is still necessary to be aware of permit issues and meet their substantive requirements. Having the most planning and administrative requirements, including air discharge, Alternative A2 (LTTD) is the least administratively feasible alternative. Because of the treatment technology involved, Alternative A3 (soil washing) would also require meeting more planning and administrative requirements than those required with Alternative A4 (off-site disposal). Therefore, Alternative A4 is more administratively feasible than Alternative A3.

The alternatives are ranked as follows for administrative feasibility (most to least feasible):

1. Alternative A5 – Containment and Collection of LNAPL Plume Area
2. Alternative A4 – LNAPL Extraction and Off-Site Disposal
3. Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing and LNAPL Extraction
4. Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption of Soils

6.2.3 Availability of Service and Materials

Given that only a barrier wall would need to be installed, which requires standard long reach excavation equipment that do not need highly skilled operators, Alternative A5 (containment and collection) has the most readily available service and materials.

Of the remaining three alternatives, Alternative A4 (off-site disposal) does not require as intensive an engineering design effort, complex equipment, skilled labor, nor extensive utility usage as Alternatives A2 (LTTD) and A3 (soil washing). Therefore, Alternative A4 has services and materials that are more readily available than the remaining two alternatives.

While Alternative A3 (soil washing) can require extensive design work associated with selecting the appropriate surfactants and rinse water treatment technologies, the equipment needed to implement the process is fairly common and readily available. With Alternative A2 (LTTD), the kiln used to heat the soil is specialized equipment, and the energy requirements can be onerous if the site is remote. Given the location of the Avery site, Alternative A3 (soil washing) requires services and materials that are more readily available than associated with Alternative A2 (LTTD).

The alternatives are ranked as follows for availability of service and materials (most to least available):

1. Alternative A5 – Containment and Collection of LNAPL Plume Area
2. Alternative A4 – LNAPL Extraction and Off-Site Disposal
3. Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing
4. Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption of Soils

6.2.4 State and Community Acceptance

For this criterion, Alternative A5 (containment and collection) has the least potential for state and community acceptance. Since a barrier system has already been implemented and it has been shown to be ineffective, it most likely will be perceived unfavorably. Alternative A2 (LTTD) has a low potential for state and community acceptance, due to potential concerns and/or opposition by community and environmental groups to its association with incineration technology. Alternative A2 (LTTD) ranks higher than Alternative A5 (containment and collection) only because it has not been tried at the site before.

Alternative A4 (off-site disposal) ranks higher than the Alternatives A2 and A5 but not as high as Alternative A3 (soil washing), which would possibly receive the most favorable state and community acceptance. While Alternative A4 will work, it can be construed as just moving the problem and taking up landfill space. Since Alternative A3 cleans the soil in a non-obtrusive way that allows for it to be reused, it has the greatest potential for obtaining state and community acceptance.

The alternatives are ranked as follows for state and community acceptance (easiest to hardest):

1. Alternative A3 – LNAPL Extraction and Ex Situ Soil Washing
2. Alternative A4 – LNAPL Extraction and Off-Site Disposal
3. Alternative A2 – LNAPL Extraction and Ex Situ Thermal Desorption of Soils
4. Alternative A5 – Containment and Collection of LNAPL Plume Area

6.3 Cost

6.3.1 Preamble

While a cost estimate prepared as part of detailed design will provide a more accurate cost, it is beyond the scope of an EE/CA. In developing the individual cost estimates, there are a number of uncertainties that must be accounted for. There is a considerable amount of site data. However, data gaps associated with the extent contamination still exist. Therefore, for Alternatives A2, A3, and A4, the volume of material to be treated or disposed of off site was increased by 10% to account for unknowns. Also for Alternatives A2 and A3, it was assumed that 10% of the initially treated material would have to undergo a second round of treatment.

For Alternative A5, the slurry wall was extended to a depth of 25 feet bgs. While groundwater is encountered at a depth of 17 feet bgs, which is considered the seasonal low, a slurry wall depth of 22 feet bgs is considered acceptable. However, in order to be conservative, an additional 3 feet in depth was added.

Finally, for all of the action alternatives, a 20% contingency factor to address potential unknowns that may increase the cost of implementing the individual alternative.

6.3.2 Cost Evaluation

In evaluating the costs of the removal action alternatives, there are three components: capital cost, annual post-removal site care cost, and total project cost.

For the Avery site, the capital costs of the action alternatives are:

Alternative A2: LNAPL Extraction and Ex Situ Thermal Desorption of Soils	$9,710,000
Alternative A3: LNAPL Extraction and Ex Situ Soil Washing	$6,620,000
Alternative A4: LNAPL Extraction and Off-Site Disposal	$7,500,000
Alternative A5: Containment and Collection of LNAPL Plume Area	$3,180,000

Only one alternative (Alternative A5, containment and collection) requires significant PRSC beyond monitoring for the effectiveness of the removal action. The estimated annual PRSC cost for PRSC is $80,000. In order to appropriately compare the individual alternatives with regards to cost, the PRSC cost was amortized using a 5% discount rate over a 30-year period. The total PRSC cost for Alternative A5 is $1,230,000.

The total project cost of an alternative is the sum of the capital cost and the amortize PRSC cost. Therefore, the total project costs of the action alternatives are:

Alternative A2: LNAPL Extraction and Ex Situ Thermal Desorption of Soils	$9,710,000
Alternative A3: LNAPL Extraction and Ex Situ Soil Washing	$6,620,000
Alternative A4: LNAPL Extraction and Off-Site Disposal (A4)	$7,500,000
Alternative A5: Containment and Collection of LNAPL Plume Area	$4,410,000

6.4 Summary of Comparative Analysis

A summary of the comparative analysis for the removal action alternatives is presented in Table 6-3.

Insert 1 of 1

Table 6-1 Summary of Effectiveness Comparison

Insert 1 of 1

Table 6-2 Summary of Implementability Comparison

Insert 1 of 1

Table 6-3 Summary of Comparative Analysis

Chapter 7 7 Recommended Removal Action Alternative

Based upon the alternative evaluations conducted in Section 6, Alternative A4, LNAPL Extraction and Off-Site Disposal, is proposed. With the exception of the no action alternative, the remaining alternatives did meet/comply with, in varying degrees, the three evaluation criterion of effectiveness, implementability, and cost.

Alternative A2, Ex Situ Thermal Desorption, would be difficult to implement administratively as well as being several million dollars more expensive than the next alternative. Although this alternative is considered to be more effective, the off-site disposal alternative also demonstrated an overall acceptable level of effectiveness, and the slight difference in effectiveness was not sufficiently off-set by the drawbacks and increased costs of LTTD.

While Alternative A3, Ex Situ Soil Washing, also ranked higher in effectiveness than the selected alternative (A4, LNAPL Extraction and Off-site Disposal), there is considerable uncertainty associated with the selection of the appropriate surfactant used to extract the contamination from the soil media. Off-site disposal also scored higher than soil washing in the implementablity category. While soil washing was determined to cost slightly less than off-site disposal, off-site disposal provides a broader ability to address/handle changes in subsurface conditions (i.e., varying contaminant concentration) than soil washing.

Alternative A5, Containment and Collection of LNAPL, was the least costly of the action alternatives. However, it was considered the least effective alternative and could potentially take up to 30-years to collect the LNAPL. Additionally, a similar type system has been in place and has not adequately addressed LNAPL seeps into the river. Public acceptance of this remedy would be doubtful.

Chapter 8 8 References

ART Engineering, LLC (ART), December 14, 2009, Soil Washing Treatability Study, Avery Landing Site, Avery, ID.

Bentcik, Larry, April 18, 2007, personal communication regarding ownership history of the Avery Landing Site with Steven Hall, Ecology and Environment, Seattle, Washington.

Cundy, Terry, April 16, 2007, Potlatch Corporation, personal communication regarding Avery Site cleanup activities with Steven Hall, Ecology and Environment, Seattle, Washington.

Ecology and Environment, Inc. (E& E), July 31, 2007, Removal Assessment Report, Avery Landing Site, Avery, Idaho, prepared for the United States Environmental Protection Agency, Seattle, Washington, under Superfund Technical Assessment and Response Team contract EP-S7-06-02, Technical Direction Document 07-03-0004.

Farallon Consulting, L.L.C. (Farallon), March 17, 2006, Failure Analysis and Preliminary Corrective Action Work Plan, Avery Landing Site, Avery, Idaho.

Golder Associates, Inc. (Golder), January 22, 2010, Engineering Evaluation/Cost Analysis, Avery Landing Site, Avery, Idaho, submitted to Potlatch Land and Lumber, LLC.

______, January 23, 2009, Final Engineering Evaluation/Cost Analysis Work Plan for the Avery Landing Site, Avery, Idaho, prepared for Potlatch Forest Products Corporation.

Google Earth, May 2010, geographical information obtained for the site.

Hart Crower, Inc. (Hart Crowser), December 15, 2000a, Remediation System Installation and Third Quarter 2000 Performance Report, Avery Landing Recover System, prepared for Potlatch Corporation.

______, August 7, 2000b, Corrective Action Plan, Avery Landing Site, Avery, Idaho, prepared for Potlatch Corporation.

Idaho Department of Environmental Quality (IDEQ), 2010, Rules of the Department of Environmental Quality, IDAPA 58.01.02, Water Quality Standards. Prepared by IDEQ, Boise, ID.

______, September 11, 2006, correspondence requesting EPA assistance at the Avery Landing Site.

______, 2004, Idaho Risk Evaluation Manual. Prepared by IDEQ, Boise, ID.

Link, P.K., Fanning, C.M., Lund, K.I., and Aleinikoff, J.N., 2007, Detrital zircons, correlation and provenance of Mesoproterozoic Belt Supergroup and correlative strata of east-central Idaho and southwest Montana: *in* Link, P.K., and Lewis, R.S., *eds*., SEPM Special Publication 86, Proterozoic geology of western North America and Siberia, p.101-128.

MacDonald, D.D., T. Berger, K. Wood, J. Brown, T. Johnsen, M.L. Haines, K. Brydges, M.J. MacDonald, S.L. Smith, and D.D. Shaw, 1999, A Compendium of Environmental Quality Benchmarks. Prepared by MacDonald Environmental Services Limited, Nanaimo, British Columbia, Canada for Environment Canada as part of the Georgia Basin Initiative (GBEI), GBEI EC-99-001.

Regional Sediment Evaluation Team (RSET), 2006, Interim Final Sediment Evaluation Framework for the Pacific Northwest. Prepared by U.S. Army Corps of Engineers - Seattle District, Portland District, Walla Walla District, and Northwestern Division; U.S. Environmental Protection Agency, Region 10; Washington Department of Ecology; Washington Department of Natural Resources; Oregon Department of Environmental Quality; Idaho Department of Environmental Quality; National Marine Fisheries Service; and U.S. Fish and Wildlife Service.

Ross, G.M., and Villeneuve, M., 2003, Provenance of the Mesoproterozoic (1.45 Ga) Belt basin (western North America): another piece in the pre-Rodinia paleogeographic puzzle: Geological Societyof America Bulletin, v. 115, p. 1191-1217.

Suter, G.W. and C.L. Tsao, 1996, Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision Oak Ridge National Laboratory, Oak Ridge, TN, ES/ER/TM.

Technical Assistance Team (TAT), not dated, Idaho Tour Presentation, Avery Groundwater Site [Trip report for November 18, 1982, site visit to Avery Landing Site].

United States Environmental Protection Agency (EPA), 2010, Regional Screening Levels (SL) for Chemical Contaminants at Superfund Site. Accessed from the internet at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_bwrun_MAY2010.pdf

______, April 21, 1999, Office of Solid Waste and Emergency Response Directive 9200.4-17P, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.

______, 1998, Guidelines for Ecological Risk Assessment, Risk Assessment Forum, USEPA, Washington, D.C., EPA/630/R-95/002F.

______, 1997, Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final, Environmental Response Team, Edison, N.J.

______, 1993, Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA. USEPA Office of Solid Waster and Emergency Response, Washington, D.C. EPA540-R-93-057.

______, 1989, Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

United States Geological Survey (USGS), 2008, National River Data Base.

URS Consultants, Inc. (URS), January 19, 1993, Site Inspection Report for the Avery Railroad Dump and Roundhouse Site, CERCLIS ID No. IDD984666313, prepared for the U.S. Environmental Protection Agency, Contract No. 68-W9-0054, Work Assignment No. 54-17-0JZZ, Seattle, Washington.

URS Greiner, Inc. (URS Greiner), October 5, 2001, Final Technical Memorandum (Rev. 3): Estimation of Background Concentrations in Soil, Sediment, and Surface Water in the Coeur d’Alene and Spokane River Basins, prepared for U.S. Environmental Protection Agency, Contract No. 68-W-98-228, Work Assignment No. 027-RI-CO-102Q, Seattle, Washington.

Western Regional Climate Center, September 13, wind data from 1996-2006 for the Coeur d'Alene Airport, Idaho. Accessed on the internet at http://www.wrcc.dri.edu/htmlfiles/westwind.final.html

______, July 30, 2010, precipitation and temperature data from 1968 through 2009 for Avery Ranger Station Number 2. Accessed on the internet at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?id0528.

Winston, Don, 2007, Revised stratigraphy and depositional history of the Helena and Wallace Formations, Mid-Proterozoic Piegan Group, Belt Supergroup, Montana and Idaho, *in* Link, P.K., and Lewis, R.S., *eds*., SEPM Special Publication 86, Proterozoic geology of western North America and Siberia, p. 65-100.

Van't Hul, Arthur W., June 1, 1970, Regional Public Health Engineer, Idaho Department of Health, Lewiston, Idaho, letter to Mr. B.J. Werley, Vice President/Chief Engineer, Chicago, Milwaukee, St. Paul, and Pacific Railroads, Chicago, Illinois.

Chapter A A

Analytical Data Summary Tables, 2007 EPA Removal Assessment

This page intentionally left blank.

Chapter B **B**

Analytical Data Summary Tables, 2009 Potlatch/Golder Field Investigation

This page intentionally left blank.

Chapter C **C**

Data Validation Memoranda for START Review of 2009 Potlatch/Golder Analytical Data

This page intentionally left blank.

Chapter D D

Avery Landing Site ARARs and TBCs

This page intentionally left blank.

Chapter E **E**

Soil Washing Treatability Study, ART Engineering 2009

(not including Attachment C, Analytical Data Reports)

This page intentionally left blank.

Chapter F **F**

Data and Assumptions for Cost Estimates

This page intentionally left blank